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PHYSICS ABSTRACTS

BEING

SCIENCE ABSTRACTS—SECTION A

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ABSTRACTS 1182-1436

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The language of an original article is indicated after the decimal number, unless the article is in English, thus: = 3 German, = 4 French, = 5 Italian, = 6 Spanish, = 82 Russian, = 956 Japanese.

MATHEMATICS

1182 513.776

Representation of measurable flows in Euclidean 3-space. KAKUTANI, S. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 16–21, *Jan.*, 1942.

1183 515.1 : 535.62

Projective transformations of colour-mixture diagrams. MACADAM, D. L. *J. Opt. Soc. Amer.*, 32, *pp.* 2–6, *Jan.*, 1942.—The algebraical relations involved in projective transformations of colour-mixture diagrams are discussed and the conditions under which either the size or the shape are invariant, are deduced. Colours having equally noticeable differences can be represented by equidistant points in some projective transformation only if, in the standard diagram, the separations of the points on any line representing a series of equally noticeably different colours are proportional to the square of the distance from some unique point on that line, and if the locus of such unique points for all linear series of colours is a straight line. Examination of experimental data suggests that this condition is not satisfied. W. D. W.

1184 517.2

On formal exponential differentiation in rings. VANDIVER, H. S. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 24–27, *Jan.*, 1942.

1185 517.384

Non-absolutely convergent integrals. JEFFERY, R. L., AND MACPHAIL, M. S. *Trans. Roy. Soc. Can.*, 35, *pp.* 41–58, *May*, 1941.

See Abstr. 1190 517.432 : 517.942.82

1186 517.522

The summation of infinite harmonic series. SODDY, F. *Proc. Roy. Soc. A*, 179, *pp.* 377–393, *Feb.* 27, 1942.—Infinite harmonic series with alternating signs, capable of being extended to infinity in both directions, can be simply transformed into rapidly converging doubly infinite series in which the successive terms are the reciprocals of any number of factors in arithmetical progression. The method may be extended to harmonic series summing to $\log_e 2$, for which, in the doubly infinite form, the denominator of one of the terms vanishes, by use of a special set of numerators termed summate numerators.

1187 517.566

On the function $H(m, a, x) = \exp(-ix)F(m+1-ia, 2m+2, 2ix)$. LOWAN, A. N., AND HORENSTEIN, W. *Phys. Rev.*, 61, *p.* 94, *Jan.* 1 *and* 15, 1942.

1188 517.942.6

The factorization of the hypergeometric equation. SCHRÖDINGER, E. *Proc. Roy. Irish Acad. A*, 47, *pp.* 53–54, *Dec.*, 1941.

1189 517.942.82

Inversion of a generalized Laplace integral. BOAS, JR., R. P. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 21–24, *Jan.*, 1942.

1190 517.942.82 : 517.432 = 3

Laplace transformation and operator calculus. WAGNER, K. W. *Arch. Elektrotechn.*, 35, *pp.* 502–506, *Sept.* 30, 1941.—Starting from Carson's integral equation describing transient phenomena due to unit impulse the author discusses the relations between the Laplace transformation on the one side, and Carson's formula and a formula derived by means of the Fourier integral and giving the time function as an integral of the so-called image function on the other side. The formulae have the general character of functional transformations which allow a change of variable. The relations to the Heaviside calculus and the question of preference of the operator function or the image function is discussed. R. N.

1191 517.948.32 : 621.3

The approximate solution of singular integral equations arising in engineering practice. HILDEBRAND, F. B. *Proc. Amer. Acad. Arts Sci.*, 74, *pp.* 287–295, *Nov.*, 1941.

1192 518.3 : 532.542

Nomograph for flow from partially filled pipes. DAVIS, D. S. *Industr. Engng Chem.*, 34, *p.* 52, *Jan.*, 1942.

1193 518.4 : 536.714

Graphical calculation of non-isothermal reactions. GREENE, J. W., SUTHERLAND, J. B., AND SKLAR, G. *Industr. Engng Chem.*, 34, *pp.* 65–67, *Jan.*, 1942.

1194 519.24

Is the frequency theory of probability adequate for all scientific purposes? KEMBLE, E. C. *Amer. J. Phys.*, 10, *pp.* 6–16, *Feb.*, 1942.

1195 519.44

A class of groups. BEST, E., AND TAUSSKY, O. *Proc. Roy. Irish Acad. A*, 47, *pp.* 55–62, *Feb.*, 1942.

1196 519.44

A generalization of the plane lattice groups. KINGSTON, J. M. *Trans. Roy. Soc. Can.*, 35, *pp.* 27–40, *May*, 1941.

ASTRONOMY

1197 521.13

Trojan satellites (limiting case). BUCHANAN, D. *Trans. Roy. Soc. Can.*, 35, *pp.* 9–25, *May*, 1941.—The equilateral triangle points of libration in the restricted three-body problem are considered, periodic oscillations near these equilibrium points being investigated for the limiting case in which the product of the finite masses is equal to 1/27. Two types of orbit are found (long- and short-period) of which the sizes and periods are functions of a component of the initial displacement from the libration point. The solutions are expressed as power series which converge for small displacements. A. HU.

See Abstr. 1215 521.153 : 523.852

See Abstr. 1361 522.6 : 535.33 : 77 : 539.371

1198 523.38 = 3

Photometric analysis of lunar eclipse of 7–8 November, 1938. GUTH, V., AND LINK, F. *Z. Astrophys.*, 20, 1, *pp.* 1–12, 1940.—Photometric measurements and visual observations made during the eclipse are examined with a view to explaining the lack of uniformity of illumination in the shadow. The normal structure of the earth's unclouded atmosphere is used to determine the theoretical density of the shadow and its dependence on position angle and radius from

the centre of the umbra. The relevant meteorological conditions are considered as modifying factors. The densities given by theory and by observation differ by about 0·66 at all distances. Absorption due to ozone is invoked to account for 0·45 of the difference; the rest is attributed to some unknown absorption. A. HU.

1199 523.51

The stone-iron meteorites called pallasites: a synthetic study of their structure and probable mode of formation. RAYLEIGH, LORD. *Proc. Roy. Soc. A*, 179, *pp.* 386–393, *Feb.* 27, 1942.—Pallasites possess a remarkable structure of olivine, enclosed in a sponge or 3-dimensional net of Ni–Fe. Structures of this character are obtained in metallurgy, but pallasites cannot have originated in the same way, because the included olivine is less fusible than the metal, while iron slag is more fusible. The structure of the specimens figured can, however, be closely imitated by pouring molten alloy into a compact layer of stone fragments. The fragments used are angular or rounded, according to the character of the pallasite to be imitated.

1200 523.67

Remarks on the spectra of comets 1941c (Paraskevopoulos–De Kock) and 1941d (Van Gent). ELVEY, C. T., SWINGS, P., AND BABCOCK, H. W. *Astrophys. J.*, 95, *p.* 218, *Jan.*, 1942.

1201 523.72

On the limb-darkening of the Sun. ASHKIN, J., NAFE, J. E., AND ROTHSTEIN, J. *Astrophys. J.*, 95, *pp.* 76–77, *Jan.*, 1942.—It is shown that the agreement between the limb-darkening, computed in second approx. using the Schwarzschild–Milne integral equation, and the observed limb-darkening in the integrated light of the sun is substantially improved by taking account of the blanketing effect.

1202 523.74

Provisional sunspot-numbers for August to October, 1941. BRUNNER, W. *Terr. Magn. Atmos. Elect.*, 46, *p.* 408, *Dec.*, 1941.

1203 523.75 = 3

Chromospheric eruptions. II. WALDMEIER, M. *Z. Astrophys.*, 20, 1, *pp.* 46–66, 1940.—[See Abstr. 2777 (1938)]. The development of a typical bright eruption (that of 13th April, 1938) is described in detail. The variations with time of the brightness of the eruption are followed by making observations of the width of $H\alpha$, i.e. the range of visibility of the eruption in Å. In the typical case this width rises to a max. of about 3 Å in some 5 min., falling slowly to 1 Å in a further 20 min. Central intensities and equivalent widths of $H\alpha$ are given for 12 eruptions. The continuous spectrum observed in 2 eruptions is due to electron scattering of photospheric light; from the intensity of this continuum an electron density of about $0{\cdot}2 \times 10^{13}$ cm.$^{-3}$ is derived, giving a hydrogen density of 3×10^{-12} gm.cm.$^{-3}$, a value 300 times as great as in prominences. Spectrohelioscopic observations of 53 eruptions and bright $H\alpha$ flocculi in the lines D_2 (Na) and D_3 (He) are given in tabular form and discussed. A. HU.

1204 523.77

Abundance of iron in the Sun. KING, R. B. *Astrophys. J.*, 95, *pp.* 82–87, *Jan.*, 1942.—A value for the abundance of neutral iron atoms in the solar reversing layer is derived from strong lines of Fe I by utilizing the absolute *f*-values and the solar equivalent widths. A solar damping constant 10 times the classical value and an excitation temperature of 4400° were assumed. The total number (neutral Fe atoms/cm.^{2} is $4{\cdot}3 \times 10^{18}$. Possible causes for apparent systematic differences in the results for various lines are discussed.

1205 523.77 = 3

Determination of damping in two Fe multiplets at the centre and limb of the Sun's disc. BRUGGENCATE, P. TEN, AND HOUTGAST, J. *Z. Astrophys.*, 20, 3, *pp.* 149–171, 1940.—Photometric observations of the central intensities and equivalent widths of 2 Fe multiplets, comprising 27 lines between 4 860 Å and 5 785 Å, are made at the centre of the Sun's disc and at 2 points close to the limb. Empirical curves of growth are constructed for both multiplets at all 3 points and compared with theoretical ones; the corresp. excitation temperatures are derived. The observed damping coeff. is about 30 times greater than the classical radiation-damping value, so that the observed wings on strong lines are due to collision damping even at high levels. The collisions are predominantly with H atoms. The number of Fe atoms in the ground state above unit cross-section of the photosphere is derived. A. HU.

1206 523.77 = 3

Comparative observations of the corona in the light of the lines 5 303, 5 694 and 6 374 Å. WALDMEIER, M. *Z. Astrophys.*, 20, 3, *pp.* 172–194, 1940.—Observing without an eclipse, the author constructs simultaneous coronal isophotes for the lines 5 303 Å and 6 374 Å, 13 pairs of contours being obtained between Jan. and July, 1940. The contours of any one pair are only roughly similar, but the mean contours agree, both lines showing the same mean intensity at a given heliographic latitude. The correlation coeff. between individual intensities is 0·72, but between the mean values it is 0·96. The max. of the isophotes show the positions of red and green coronal streamers analogous to the white outer streamers observed during eclipses; the most prominent occur at the latitudes of the spot zones (10° at this epoch), with secondary streamers near 62° and perhaps at 80°. The total numbers of red and green streamers are equal, but appear simultaneously in only 40% of the cases. A single observation in the light of the weak yellow line at 5 694 Å is discussed. [See Abstr. 1207 (1942)]. A. HU.

1207 523.77 = 3

Variations in form of the corona. WALDMEIER, M. *Z. Astrophys.*, 20, 3, *pp.* 195–213, 1940.—[See Abstr. 1206 (1942)]. Two methods are described for studying the inner corona outside eclipse in light of the 5 303 Å line. The first consists in tracing isophotes in the coronal region. By this method it is shown that the day-to-day variations in form are partly real and partly due to the Sun's rotation; the short-period (hourly) variations are mostly real. The lifetime of the coronal streamers ranges from 1 hr. to several weeks, with a mean value of 1 or 2 days; the short-lived ones are small and frequent, the persistent ones larger and less common. A streamer develops more

rapidly than it disintegrates. The second method uses the principle of the prominence spectroscope, the corona being observed directly in monochromatic light. Two coronal arcs have been thus observed to show outward velocities of about 10 km./sec. A. HU.

See Abstr. 1278 523.77 : 535.342

1208 523.81

The nearest stars. KUIPER, G. P. *Astrophys. J.*, 95, *pp.* 201–212, *Jan.*, 1942.—A list is given of the known stars with $p \geqslant 0''{\cdot}095$ to show which data are still lacking. The data define the distribution of $M(v)$ and Sp. The incompleteness of our knowledge of the nearest stars fainter than $M = 11$ is shown. Some results are derived from the nearest binaries and multiple stars; larger numbers are required for statistical treatment. Of the masses exceeding that of the Sun, at least 2/3 have divided into stable binary or multiple systems.

1209 523.82 = 3

The law of reddening in ζ Persei. KIENLE, H. *Z. Astrophys.*, 20, 1, *pp.* 13–24, 1940.—The author reviews all observational material regarding the monochromatic magnitude differences between ζ Pers and ϵ Pers in the wavelength region $0{\cdot}3 < \lambda < 1{\cdot}0\,\mu$. The relative reddening is expressed as a power series in $1/\lambda$, and the absorption is found to depend on wavelength according to the relation $I_\lambda = I_0 \exp(-k\lambda^{-\alpha})$, α being appreciably < 1. A. HU.

1210 523.82 = 3

Photo-electric magnitudes and colour indices of 94 standard stars. GÜSSOW, M. *Z. Astrophys.*, 20, 1, *pp.* 25–45, 1940.—A photo-electric photometer using a K–A cell is employed, with blue and yellow filters, on the 31 cm. Babelsberg refractor to measure colour indices and magnitude differences amongst stars of all classes and of magnitudes between 0 and 6. The instrument and method of observation are described, and the measurement of atmospheric extinction is discussed. The effective wavelengths of the filters used are 4 203 Å and 4 488 Å. A process of linking of the observed brightness differences in the blue region gives a series of blue magnitudes which, when combined with the observed colour indices, give derived yellow magnitudes in agreement with the observed intercomparisons in the yellow region. A. HU.

See Abstr. 1216 523.83 : 523.852

1211 523.841

The pulsation theory of long-period variables. SCOTT, R. M. *Astrophys. J.*, 95, *pp.* 58–72, *Jan.*, 1942.—The suggestion is made that the variation of the velocity of the emission material whose bright lines appear in the spectra of long-period variables indicates a variation in the velocity of the photosphere. The photospheric motions obtained from this assumption, when combined with the radiometric observations, lead to consistent abs. magnitudes and diameters for 5 stars. A solution of Schwarzschild's pulsation equation, based upon the data made available by the knowledge of the parallax and diameter of Mira, yielded a luminosity curve which fits the observed curve. The solution indicated reasonable conditions in the surface layers. The outer layers of the star are in convective instability. The pressure varies over a range of more than 70–1, while the density varies through a range of nearly 1811; max. density and pressure occur at max. light.

1212 523.852

A note on the distribution of mass and luminosity in Messier 33. ALLER, L. H. *Astrophys. J.*, 95, *pp.* 48–51, *Jan.*, 1942.—The observed rot. velocities in Messier 33 are compared with theoretical velocity curves computed on 2 assumptions regarding the mass distribution. The observations agree with the model in which const. density is assumed to about 1 000 parsecs from the centre.

1213 523.852 = 3

Photometric and statistical study of the S. Milky Way. JUNG, B., AND TRIPPE, W. *Z. Astrophys.*, 20, 2, *pp.* 69–90, 1940.—A short description of the preparation of a photographic atlas of the Milky Way from Carina to Scutum, using 50 mm. focus cameras at the Windhuk outstation of Breslau Observatory. After a review of previous statistical studies of a few selected regions in this area, Windhuk plates of 4 regions in Centaurus, taken with a 240 mm. focus anastigmat, are discussed in detail, and estimates of absorption are made from star-counts. Similar counts are made and discussed for 7 regions near S.A. 180 and for 6 close to S.A. 110 in Scutum, Serpens and Aquila. A. HU.

1214 523.852

Distribution of mass in the spiral nebulae Messier 31 and Messier 33. WYSE, A. B., AND MAYALL, N. U. *Astrophys. J.*, 95, *pp.* 24–46, *Jan.*, 1942.—The relation between density distribution in a plane, circularly symmetrical disc, and the central force exerted upon points in its plane, is investigated. For a disc in which the surface density can be expressed as a polynomial of the 5th degree in the distance from the centre, it is possible to determine the force curve in the plane for interior and exterior points. The determination consists of the simultaneous solution of 5 linear equations. The curve of force can be converted into a curve of rot. velocity if simple circular motion is assumed. Conversely, it is possible to find the density distribution corresponding to a given force curve. The observed rotational-velocity curves of M 31 and M 33 are adequately represented by thin-disc models. The solutions indicate a wide distribution of mass throughout both systems with but little tendency toward central concentration. The const. of galactic rotation are re-examined. The high central concentration of matter, commonly quoted for the Galaxy, is not a necessary consequence of the observational data.

1215 523.852 : 521.153

The equilibrium and stability of ring-shaped "barred spirals." RANDERS, G. *Astrophys. J.*, 95, *pp.* 88–111, *Jan.*, 1942.—A simple hydrodynamic model of the ring-shaped extragalactic nebulae is considered. It is shown that these nebulae are unstable and will form mass condensations rotating with the ring. These mass condensations will grow and break up the ring. It follows that the ring-shaped nebulae are unstable and cannot represent any final evolution pattern. The relation of the rings to other patterns of extragalactic nebulae is discussed.

1216 523.852 : 523.83

The rotation of the spiral nebula Messier 3. MAYALL, N. U., AND ALLER, L. H. *Astrophys. J.*,

95, *pp.* 5–23, *Jan.*, 1942.—The investigation is based on radial-velocity observations of 25 bright-line condensations well distributed over the spiral and upon long exposures recording the spectrum of the unresolved nebulosity of the nuclear region. By using the results, together with the assumption of simple circular motion in the plane, rot. velocities of low precision are obtained for the individual condensations and combined to give a first approx. to the rotational-velocity curve. The main body of the spiral appears to rotate like a solid body (rot. vel. increases uniformly with distance), while the outer parts appear to rotate like a planetary system (rot. vel. decreases with distance). The transition occurs in the vicinity of 16′ (1 000 parsecs) from the centre, at which distance the rot. vel. attains a max. The observations define the character of the motion to the extreme limits of the spiral. Comparison of the results with similar ones for the solar neighbourhood of the Galaxy strengthens the hypothesis that the sun is located at a considerable distance from the main body of our own stellar system.

1217 523.852 : 523.87

The spectra of the emission nebulosities in Messier 33. ALLER, L. H. *Astrophys. J.*, 95, *pp.* 52–57, *Jan.*, 1942.—The emission nebulosities in Messier 33 are similar in spectral characteristics to those of our own Galaxy and to the low-excitation planetary IC 418. The evidence suggests that the oxygen is predominantly in the single ionized condition.

1218 523.852 : 523.873

Physical processes in gaseous nebulae. XVII. Fluorescence in high-excitation planetaries. MENZEL, D. H., AND ALLER, L. H. *Astrophys. J.*, 94, *pp.* 436–448, *Nov.*, 1941.—[See Abstr. 2005 (1941)]. The authors test quantitatively the suggestion that the occurrence of certain permitted O III lines in the ultra-violet spectra of high-excitation planetary nebulae is due to the direct return or cascade of an electron from the $2p3d\,^3P_2$ level populated by absorption of the "Lyman α" radiation from He II. The appropriate equations of statistical equilibrium are set up for the excited levels, and the relative intensities of the observed ultra-violet lines are predicted and compared with observation. Theory and observation agree within experimental error. The intensity in O III 303·80 is from 10^2 to 10^3 times greater than that radiated by the nuclear star; this excess is attributed to cyclic processes resulting from ionization of He+. The paper contains tables of wavelengths, terms, strengths, *f*-values, and *A*'s for the transitions involved in the fluorescent mechanism. A. HU.

1219 523.87

Spectrographic observations of peculiar stars. III. SWINGS, P., AND STRUVE, O. *Astrophys. J.*, 95, *pp.* 152–160, *Jan.*, 1942.—Describes recent changes in the spectra of AX Per, Z And, AG Peg and R Aqr, also recent spectrograms of the unusually red bright-line star MWC 349. [See Abstr. 2528 (1941)].

1220 523.87

The spectrum of α Carinae. GREENSTEIN, J. L. *Astrophys. J.*, 95, *pp.* 161–200, *Jan.*, 1942.—The wavelengths and identifications of nearly 1 000 lines measured on McDonald coudé spectrograms of α Car, a supergiant F0 star, are given. The measured equivalent widths for 300 lines are included. The spectrum is noteworthy for strong H lines, in spite of an abs. mag. of $-3^m.5$. Ionized metals and Fe I dominate; C I, N I, and Si II are present. A curve of growth, based on semi-theoretical intensities, has been constructed for Fe I and also for the ionized metals. The H wings correspond to $\log N \approx 18$; the opacity of the reversing layer is completely explained by the H atoms. The H lines produce a weakening of other lines located in the Stark wings; the weakening is interpreted theoretically. The ionization equilibria have been studied quantitatively and lead to an ionization temperature of 7 300° and $\log P_e = 1{\cdot}0$. Estimates of the abundance of the lighter elements are made; some evidence for stratification is found in the abnormally high abundance of H.

1221 523.87

The spectra of α Cygni and α Lyrae in the region λλ3 000–3 300. RUSH, J. H. *Astrophys. J.*, 95, *pp.* 213–217, *Jan.*, 1942.—The wavelengths of absorption lines in α Cygni and in α Lyrae are listed between λ3 040 and λ3 298.

1222 523.87 = 3

The absolute intensity distribution in the continuous spectrum of the average A0 star. BEILEKE, F., KIENLE, H., AND WEMPE, J. *Z. Astrophys.*, 20, 2, *pp.* 91–147, 1940.—The authors discuss physical principles involved in comparing the continuous radiation of a star with that of a black body, through the intermediary of a tungsten-strip lamp and a blue filter. A full description is given of the calibration of the artificial star. The observations made to compare this source with a selected star (normally α Lyrae) are described in detail, together with the corrections needed to allow for absorption. The results are reduced to the mean of 8 A0 stars, measurements being made at 28 selected points in the spectral range 3 700 Å–6 320 Å. The mean gradient in the region $1{\cdot}55 < 1/\lambda < 2{\cdot}50$ is $1{\cdot}07 \pm 0{\cdot}03$, corresp. to a colour temperature of $16\,100° \pm 800°$ K. Deviations from linearity with $1/\lambda$ are expressed by giving a "red" and a "blue" gradient: $\phi_r = 1{\cdot}33$ (12 200°) for $1{\cdot}58 < 1/\lambda < 2{\cdot}05$, and $\phi_b = 0{\cdot}81$ (23 500°) for $2{\cdot}05 < 1/\lambda < 2{\cdot}50$. A. HU.

1223 523.87 = 3

Double reversal of Ca II lines in spectrum of α Orionis. WELLMANN, P. *Z. Astrophys.*, 20, 3, *pp.* 214–220, 1940.—[See Abstr. 2598 (1940)]. A photometric study is made of the H and K lines on spectrograms of this star; they show an unsymmetrical double reversal, which is attributed to an outward movement involving 1 part in 10^4 of the atmospheric ionized Ca. These ions are considered to belong to a chromospheric emission layer in which a temperature inversion exists, and which has a velocity of the order of 10 km./sec. A. HU.

1224 523.87 = 3

Spectrophotometric studies of Cepheid variables. XI. The periodic fluctuations in derived physical properties of 17 Cepheids. BECKER, W. *Z. Astrophys.*, 20, 3, *pp.* 221–238, 1940.—Unobservable data—stellar radii, accelerations due to gravity, and mean densities—can be derived from observed properties such as magnitude, colour temperature, radial velocity and spectral type. The observed light variation of a

Cepheid is divided into 2 parts, one due to the pulsation effect, the other to the temperature variation. The magnitude of the latter enables an estimate to be made of the periodic variation of radiation temperature which agrees with the value derived from colour-temperature observations. Tedious spectrophotometric measures can be replaced by a light curve at a single wavelength, a radial-velocity curve, and a colour-index measurement at any desired phase. Derived data are tabulated for 17 Cepheids, the median values and the amplitudes being given. Magnitudes and temperatures are also tabulated, phase by phase, for the wavelengths 5 570 Å and 4 100 Å. A. HU.

See Abstr. 1217 523.87 : 523.852

1225 523.872

Intensity anomalies in α Cygni. ALLER, L. H. *Astrophys. J.*, 95, *pp.* 73–75, *Jan.*, 1942.—The lines of Cr II and Ti II do not fit the curve of growth determined by the Fe II atoms. This curve is similar to the one determined by Struve and Elvey [Abstr. 1905 (1934)]. Interlocking or emission arising from chromospheric effects, which the elementary curve-of-growth theory does not take into account, seems the most likely explanation of the observed discrepancy.

1226 523.873

The spectra of Wolf–Rayet stars and related objects. SWINGS, P. *Astrophys. J.*, 95, *pp.* 112–133, *Jan.*, 1942.—New data are given for the spectra of Wolf–Rayet stars. The spectra of two Of stars are described, and some properties of the Of shells are discussed, especially the ionization conditions and the excitation process. The absence of well-marked dilution effects and other considerations suggest that the size of a Wolf–Rayet shell is not much larger than that of the photospheric surface, so that an occultation effect should be expected in certain cases. The relative abundances of C and N in the ejected shells of Wolf–Rayet, Of, and P Cygni stars, as well as of novae, are discussed. Suggestions are made concerning the classification, abs. magnitudes, temperatures and radii, of Wolf–Rayet stars and planetary nuclei, as well as concerning the application of Zanstra's theory to the nebulae with a Wolf–Rayet nucleus or to the Wolf–Rayet stars themselves.

See Abstr. 1218 523.873 : 523.852

1227 526.98 = 3

Stereo-cartograph A6 of the HCH. Wild A.G., Heerbrugg. VOEGELI, R. *Schweiz. Bauztg*, 118, *pp.* 120–122, *Sept.* 6, 1941.—A detailed explanation is given of the principle and method of use of the stereo-cartograph for the preparation of maps from air-photographs taken with the optical axes of cameras directed approx. vertically downwards. The explanation is illustrated by a typical example. The apparatus is relatively simple and inexpensive, and of a high order of accuracy. R. E. N.

PHYSICS

1228 530.12

Time concept in restricted relativity. EPSTEIN, P. S. *Amer. J. Phys.*, 10, *pp.* 1–6, *Feb.*, 1942.—Criticisms of Dingle's ideas on special relativity. It is assumed that, when a clock is set in motion, it does in fact alter its rate of working, and not that special relativity merely gives the transformation rule from the time-co-ordinates of one observer to those used by another, relatively moving. A clock is defined as a succession of events which can be identified by different observers without recourse to co-ordinate systems. Such a clock always shows the same changes of rate when set in motion. It is claimed that the Lorentz contraction is real. If the equation for the period of a simple pendulum is transformed according to the Lorentz rules for the transformations of mass, length and electromagnetic force, the period changes according to the rule for the "dilatation of time." It is argued that this is a dynamical explanation of the dilatation, which is therefore also real. G. C. McV.

1229 530.12

Some disputed questions in the philosophy of the physical sciences. WHITTAKER, E. T. *Proc. Roy. Soc. Edinb. A*, 61, 2, *pp.* 160–175, 1942.—Deals with the question of fundamental postulates necessary for mathematical deduction of the complete set of laws of the material universe. The author suggests that much of modern science is based on "postulates of impotence," which are generalizations from experience. Eddington's "epistemological principles" are discussed. It is shown that the argument that the variation of mass with velocity is epistemological in origin omits to state that relativist mechanics cannot be developed without the reduction to Newtonian mechanics. Since Newtonian mechanics are not based on epistemology, relativist mechanics cannot be entirely epistemological. G. C. McV.

See Abstr. 1283 530.12 : 535.41

1230 530.145

On Lorentz invariance in the quantum theory. II. EDDINGTON, A. *Proc. Camb. Phil. Soc.*, 38, *pp.* 201–209, *April*, 1942.—The reply of Dirac, Peierls and Pryce, to criticism of the usual theory of the eigenfunctions of a H atom is considered. The usual text-book treatment needs amendment, as it is based on a fundamental fallacy in the application of the Lorentz transformation. [See Abstract 1930 (1939)]. A. J. M.

1231 530.145

On Lorentz invariance in the quantum theory. DIRAC, P. A. M., PEIERLS, R., AND PRYCE, M. H. L. *Proc. Camb. Phil. Soc.*, 38, *pp.* 193–200, *April*, 1942.—The objection raised by Eddington [see Abstr. 1230 (1942)] to the use of the Lorentz transformation in quantum mechanics when applied to the H atom or the behaviour of a degenerate gas is discussed. A. J. M.

1232 531.19

The statistical mechanics of many component gases. FUCHS, K. *Proc. Roy. Soc. A*, 179, *pp.* 408–432, *Feb.* 27, 1942.—The theory of condensing systems is generalized for a mixture of an arbitrary number of gases. Strict equations for chemical equilibrium in a mixture of gases are derived. For sufficiently small pressures they reduce to the law of mass action.

1233 531.221

Rectangular plate loaded along two adjacent edges by couples in its own plane. OSGOOD, W. R. *J. Res. Nat. Bur. Stand., Wash.*, 28, *pp.* 159–163, *Feb.*, 1942.—A. and L. Föppl give an approx. solution for the stresses in the rectangular knee of an L-shaped plate

loaded by couples acting on the legs in the plane of the plate. A solution is presented here that is exact in the sense that the equations of equilibrium and the condition of compatibility (for 2-dimensional systems) are satisfied at every point. Small self-equilibrated stresses remain along the free edges of the knee.

See Abstr. 1234 531.231 : 531.537

1234 531.537 : 531.231

Virtual masses and moments of inertia of discs and cylinders in various liquids. YU YEE-TAK. *J. Appl. Phys.*, 13, *pp.* 66–69, *Jan.*, 1942.—An experimental method, employing a torsion pendulum, for determining the increase or "virtual" moment of inertia or mass of a body due to the body's motion in a liquid is described. Data relating to the motion of discs and cylinders in water, gasoline and CCl_4 are given, and show satisfactory agrement with results deduced from Lamb's theory. J. S. G. T.

1235 531.537 : 532.527

Yule's method of investigating periodicities of disturbed series. The motion of a pendulum in a turbulent fluid. SCHUMANN, T. E. W. *Phil. Mag.*, 33, *pp.* 138–150, *Feb.*, 1942.—Yule's method of treating "disturbed" simple harmonic motion is employed to develop the theory of the motion of a pendulum subjected to a continuous fluctuating force. Statistical characteristics of the motion are expressed in terms of those of the disturbing force. A method for determining experimentally the character of the turbulent motion of a fluid by means of a suitable rigid pendulum is suggested. J. S. G. T.

1236 531.6

Should one stop or turn in order to avoid an automobile collision? CHAPMAN, S. *Amer. J. Phys.*, 10, *pp.* 22–27, *Feb.*, 1942.—The case is considered of a motor entering at high speed a main road from a side road, there being a wall in front of the motorist. He may (i) steer straight ahead and brake fully, or (ii) turn without braking, or combine (i) and (ii). The second choice gives the sharpest turn, but it is shown by elementary and also by more advanced proof that the proper choice is the straight stop. The problem is modified by supposing the wall to be too close for the car to be stopped in the straight path. Other simple problems are discussed which are concerned only with circular arcs or straight stops, such as that of 2 cars approaching each other at rt. angles with the same speed. G. E. A.

1237 531.66

Collision relations. PARS, L. A. *Phil. Mag.*, 33, *pp.* 96–101, *Feb.*, 1942.—The two types of collision examined are exemplified by the billiard-ball problem and the collision of an α-particle with an atomic nucleus. The results are proved by simple vector diagrams. A more simplified diagram holds for the important case in which the second sphere is initially at rest and the impact is perfectly elastic, and also when 2 particles are under a mutual attraction or repulsion. The results are independent of the particular law of force between the particles. G. E. A.

See Abstr. 1426 531.7 : 536.41 : 548

1238 531.73

Volume by overflow. JONES, A. T. *Amer. J. Phys.*, 10, *pp.* 51–52, *Feb.*, 1942.

See Abstr. 1398 532.1 : 532.77 : 541.18

See Abstr. 1401 532.1 : 541.182

See Abstr. 1406 532.1 : 541.182.6

See Abstr. 1396 532.1 : 541.24 : 541.18

1239 532.1 : 621.89 = 3

Some considerations on the nature of lubricant oils. LINKE, R. *Kolloid Z.*, 97, *pp.* 189–192, *Nov.*, 1941.—[Abstr. 857 B (1942)].

See Abstr. 1249 532.13 : 532.77

1240 532.13 : 541.182.6 = 3

On the influence of solvatation on viscosity of solutions. PHILIPPOFF, W., AND HESS, K. *Kolloid Z.*, 97, *pp.* 170–176, *Nov.*, 1941.—The influence of an active solvatizing group was found to be stronger than that of the chain length. The effect of the solvent was also investigated and compared with that for lyophil colloids consisting of highly polymerized organic substances. R. N.

1241 532.511 : 536.1

Corresponding problems in periodic and steady flow. I. GREEN, G. *Phil. Mag.*, 33, *pp.* 102–114, *Feb.*, 1942.—A mathematical study dealing with the relations between the solutions of the wave equation and of the general equation governing heat conduction. The fundamental idea used is that every periodic solution of the former can be employed to provide a corresponding continuous-flow solution of the equation: $\nabla^2(v) = 0$. The main theorem required in the application of the process is demonstrated, and the method of obtaining solutions by its means is tested by applying it to problems whose solutions are known. G. E. A.

See Abstr. 1235 532.527 : 531.537

1242 532.542

Poiseuille's observations on blood flow lead to a law in hydrodynamics. HERRICK, J. F. *Amer. J. Phys.*, 10, *pp.* 33–39, *Feb.*, 1942.—Poiseuille's investigations relating to the flow of blood in the capillaries of animals are briefly and interestingly reviewed. J. S. G. T.

See Abstr. 1192 532.542 : 518.3

1243 532.582

Resistance to the uniform motion of a solid through a viscous liquid. BURWELL, JR., J. T. *J. Appl. Phys.*, 12, *pp.* 257–258, *March*, 1941.—Criticism. [Abstr. 3071 (1940)].

1244 532.582

Resistance to the uniform motion of a solid through a viscous liquid. II. BLOCK, R. B. *J. Appl. Phys.*, 13, *pp.* 56–65, *Jan.*, 1942.—The author replies to adverse criticism by Burwell of results contained in the author's previous paper which gave evidence for the assumption of liquid slip at the surface of a solid in motion through a viscous liquid, the experimental work being done with a rolling-ball type of viscometer. [See Abstr. 3071 (1940) and 1243 (1942)]. J. S. G. T.

1245 532.596

Laplace's differential equations for the tides. PROUDMAN, J. *Proc. Roy. Soc. A*, 179, *pp.* 261–288, *Jan.* 23, 1942.—The validity of the assumptions made by Laplace is investigated, the analysis being confined to the case of a homogeneous ocean. Bjerknes and co-workers considered the neglect of vertical accelera-

tion in the analysis a serious error; Brillouin and Coulomb that Laplace's equations did not appear to be valid for the semi-diurnal constituent; Solberg has questioned the validity of Laplace's theory. The chief result of the present paper is to modify very considerably the impression created by Bjerknes and his co-authors (*Physikalische Hydrodynamik*, 1933, *pp.* 450–452). Their emphatic conclusions are based on the possibility of the existence of cellular oscillations of diurnal period, and on the possibility of resonance caused by tide-generating forces of equal period. Such cellular oscillations are only possible when the horizontal wavelengths are of the same order of magnitude as the depth, and this condition is not present in actual ocean tides. Convergence difficulties referred to by Brillouin and Coulomb are also attributable to the dynamically possible oscillations of very short horizontal wavelength. An examination of Solberg's analysis (*Astrophys. Norveg.*, 1936, I, 237–240) shows that the necessary correction to the solution of Laplace's equation is very slight. J. S. G. T.

See Abstr. 1397 532.61 : 541.18

See Abstr. 1250 532.612.4 : 532.77

1246 532.62

Interaction between adsorbed substances of simple constitution and insoluble monolayers. II. Pankhurst, K. G. A. *Proc. Roy. Soc. A*, 179, *pp.* 393–399, *Feb.* 27, 1942.—[See Abstr. 1957 (1939)]. Penetration of monolayers of aliphatic substances and sterols, by aliphatic alcohols and acids of chain length from 5 to 8 carbons, is similar to that by the 4-carbon alcohol and acid except that it is much more powerful. *p*-ethyl phenol penetrates much more than phenol. Each CH_2 group added to the hydrocarbon chain decreases the conc. required for equal penetration by a factor of about 4·5. The penetration is, with these substances, non-specific, resulting only in a disruption of the cohesion of the monolayer. A single-wire-surface balance, sensitive to 0·01 dyne/cm., is described.

1247 532.62

A proposed general structure for condensed monomolecular films. Alexander, A. E. *Proc. Roy. Soc. A*, 179, *pp.* 486–499, *Feb.* 27, 1942.—From the structures of condensed films discussed previously [Abstr. 1749 (1941)], certain generalizations are suggested. In the least compressible region the long chains are vertically orientated and close-packed, but not as tightly as is possible in the 3-dimensional crystal. In the more compressible region the behaviour appears to be intermediate. All known classes of condensed monolayers are grouped according to the factors responsible for determining the limiting area. The physical states of monolayers, and the factors by which they are influenced, are briefly discussed.

See Abstr. 1418 532.62 : 541.66

See Abstr. 1251 532.635 : 532.77

See Abstr. 1351 532.7 : 541.6 : 539.2

See Abstr. 1252 532.712 : 532.77

1248 532.72

The osmotic coefficients of some organic compounds in relation to their chemical constitution. Robinson, R. A., Smith, P. K., and Smith, E. R. B. *Trans. Faraday Soc.*, 38, *pp.* 63–70, *Feb.–March*, 1942.—Isopiestic measurements have been made on solutions of sucrose and KCl. The osmotic coeff. and v.p. of sucrose solutions have been evaluated. Evidence has been sought for a difference in v.p. of solutions of optically active and racemic compounds, with negative results in the cases of *dl* and *d* tartaric acid and *dl*, *d* and *l* alanine. The introduction of hydroxyl groups into a dibasic acid molecule has been shown to have a marked effect in raising the osmotic coeff. of the acid. The osmotic and activity coeff. of sodium fumarate are found to be higher than those of the maleate. This is consistent with the view that the fumarate, with a *trans*-configuration, is almost completely dissociated, whereas the maleate, with a *cis*-configuration, exhibits ion pair formation.

See Abstr. 1398 532.77 : 532.1 : 541.18

1249 532.77 : 532.13

Macromolecular properties of linear polyesters. The viscous flow and kinetic interaction in solution of ω-OH-undecanoic self-polyesters. Baker, W. O., Fuller, C. S., and Heiss, Jr., J. H. *J. Amer. Chem. Soc.*, 63, *pp.* 3316–3321, *Dec.*, 1941.

1250 532.77 : 532.612.4

The surface tension of solutions of electrolytes as a function of the concentration. III. Sodium chloride. Jones, G., and Ray, W. A. *J. Amer. Chem. Soc.*, 63, *pp.* 3262–3263, *Dec.*, 1941.—[See Abstr. 340 (1941)]. The relative surface tensions of aqueous solutions of NaCl have been measured from 0·001 to 2 molar at 25°. At extreme dilution there is a min. in the surface-tension/conc. curve. At moderate and high conc. NaCl acts like a typical capillary-inactive salt, increasing the surface tension of water slightly and almost linearly with increasing conc.

1251 532.77 : 532.635

The structure of surfaces of solutions. Alexander A. E. *Trans. Faraday Soc.*, 38, *pp.* 54–64, *Feb.–March*, 1942.—A critical examination has been made of McBain and co-workers' recent suggestions [Abstr. 1457 (1941)] that the surfaces of solutions are very deep and complex, and differ fundamentally from insoluble mono-layers. Spontaneous formation of a "surface pellicle" has been shown as unlikely with this type of compound, and evidence is reviewed which indicates the adsorbed film to be monomolecular. Such an adsorbed mono-layer, when compressed, behaved as if the orientated solute molecules were unable to dissolve with sufficient rapidity and so might form micro-crystals on the surface which then redissolved comparatively slowly. The effects observed by McBain and collaborators on ageing and compressing the surfaces of solutions, and the spreading of oils upon such solutions, are readily interpreted from this standpoint. The calculated adsorption, both with hydrocinnamic and lauryl sulphonic acids, agrees well with the experimental data from microtome measurements on the assumption of a monolayer. The reason for the disagreement between the experimental and calculated data from the Gibbs equation is briefly discussed, and a simple explanation, based upon the inability of the micelles to exist in the interface, is suggested. It is concluded that a monomolecular adsorbed film provides a quite adequate explanation for all the data at present available.

H. H. HO.

1252 532.77 : 532.712

The vapour pressures and osmotic coefficients of solutions of the sodium salts of a series of fatty acids at 25°. SMITH, E. R. B., AND ROBINSON, R. A. *Trans. Faraday Soc.*, 38, *pp.* 70–78, *Feb.–March*, 1942.—Isopiestic v.p. measurements have been made at 25° on solutions of Na salts of 10 fatty acids from the formate to the caprate. Tables of osmotic and activity coeff. are given, also a graph of the molal v.p. lowering of each solution. It is shown that the data are consistent with micelle formation in the case of the butyrate and the heavier salts, together with ionic association between the Na ions and the polymerized anions. Quantitative evaluation of the degree of polymerization and the amount of ionic association is difficult, but, by an analogy with the thermodynamic properties of polyvalent salts, it is found that Na caproate resembles $Ca(NO_3)_2$ and Na pelargonate resembles $K_4Fe(CN)_6$.

1253 533.15

Mechanical concentration of gases. MAIER, C. G. *Bull. U.S. Bur. Min.*, *No.* 431, [148 *pp*], 1940.—As an alternative method, the application of diffusion methods to technology is examined and developed in detail. Theoretical principles and their mathematical treatment are set out, followed by a report of preliminary experiments with an atmolyser comprising the diffuser proper, units for vapour generation and control, static pressure control and vapour condensers. A solution of the problem of adapting atmolysis to technical purposes lies in the use of condensable vapour as diffusive agent. Data and 23 characteristic curves are given for tests of various materials and types of diffusion boundaries and various diffusive agents. Results are analysed and discussed. N. M. B.

1254 533.15

An elementary theory of thermal diffusion. FÜRTH, R. *Proc. Roy. Soc. A*, 179, *pp.* 461–469, *Feb.* 27, 1942.—An approx. but elementary theory is given by the application of a method similar to that used by Meyer for the treatment of ordinary diffusion. It leads to an approx. formula for the thermal diffusion ratio, a discussion of which shows that it accounts for many of the characteristic properties of thermal diffusion.

1255 533.15 : 541.183.5 = 3

Surface diffusion of carbon dioxide in active carbon. WICKE, E., AND KALLENBACH, R. *Kolloid Z.*, 97, *pp.* 135–151, *Nov.*, 1941.—The part played by the 3 kinds of diffusion, viz. ordinary diffusion, Knudsen flow and surface diffusion, and their pressure and temperature dependence, are investigated theoretically and experimentally. The measurements were made with a glass frit, a clay grain and active carbons swept on one side with a flow of $N_2 + CO_2$ and on the other side with N_2. The diffused parts of CO_2 carried away by the N_2 are measured in a sensitive equipment for determining differentially the heat-conductivity. The pressure dependence was determined at 0°C. between 1 atm. and 100 mm. Hg and the temperature dependence at 1 atm. between 0° and 200°C. While the measurements made with glass, clay and medical carbon, show mainly ordinary diffusion and Knudsen flow, with 2 technical carbons a considerable amount of surface diffusion was found. A distinction is made between pervading and partial surface diffusion, the latter being effective in extremely fine pores only, while elsewhere space diffusion takes place. The heat dependence is discussed with regard to its relation to heat of adsorption. For one of the test pieces the "diffusion surface" was determined, i.e. the total range of isobars and isotherms. R. N.

1256 533.2

Effects of heat capacity lag in gas dynamics. KANTROWITZ, A. *J. Chem. Phys.*, 10, *p.* 145, *Feb.*, 1942.

1257 533.7

A demonstration in kinetic theory. MILLER, JR., P. H., AND LANGBERG, E. L. *Amer. J. Phys.*, 10, *pp.* 20–21, *Feb.*, 1942.—Proceeding from the expression for the mean square velocity of a gas molecule in terms of the temperature of the gas, it is deduced that, if a small plane is moved through air, a slight rise of temperature should be expected at the advancing face and a slight lowering at the back face. This is verified qualitatively by rotating thermopiles supported by Lucite spools in a vacuum of 1/100th mm. of Hg at a linear speed of 10^3 to 5×10^3 cm./sec. The effect of heat conduction in the experiment is appreciable, and a correction for it is calculated. When the motor was reversed, a cooling was observed at the advancing face. An explanation of this is suggested. G. E. A.

1258 534.15 : 621.436 : 621.824

The axial vibration of Diesel engine crankshafts. POOLE, R. *J. and Proc. Instn Mech. Engrs*, 146, *pp.* 167–182, *Feb.*, 1942.—[Abstr. 846 B (1942)].

1259 534.22

The velocity of sound in methyl methacrylate polymer. WEBER, L. R., AND GOEDER, F. P. *Phys. Rev.*, 61, *pp.* 94–95, *Jan.* 1 *and* 15, 1942.

1260 534.26

Supersonic dispersion in gases. The vibrational activation of the acetaldehyde molecule. ALEXANDER, E. A., AND LAMBERT, J. D. *Proc. Roy. Soc. A*, 179, *pp.* 499–511, *Feb.* 27, 1942.—An investigation of the supersonic dispersion in acetaldehyde vapour was carried out in piezo-electric, magnetostriction and Kundt's tube interferometers over as wide a range of frequency and pressure as possible. Acetaldehyde exhibits a multiple-disperson region which is independently confirmed by absorption measurements. Certain intramolecular vibrations are activated independently.

1261 534.37 : 621.317.39

An acoustic tube for measuring the sound absorption coefficients of small samples. LOYE, D. P., AND MORGAN, R. L. *J. Acoust. Soc. Amer.*, 13, *pp.* 261–264, *Jan.*, 1942.—[Abstr. 665 B (1942)].

1262 534.39 : 541.6

Further studies on a molecular rearrangement induced by ultrasonic waves. BARRETT, E. W., AND PORTER, C. W. *J. Amer. Chem. Soc.*, 63, *pp.* 3434–3435, *Dec.*, 1941.—The rate of rearrangement of benzazide in aniline solution has been studied at frequencies of 16, 275 and 478 kc./s., and with power inputs ranging from 100 W to 250 W. The rate of rearrangement is $\propto$ energy of vibration and independent of frequency.

1263 534.84 : 621.396.712.3

Performance of broadcast studios designed with convex surfaces of plywood. BONER, C. P. *J. Acoust.*

Soc. Amer., 13, *pp.* 244–247, *Jan.*, 1942.—[Abstr. 704 B (1942)].

1264 534.84 : 621.396.712.3

Polycylindrical diffusers in room acoustic design. VOLKMANN, J. E. *J. Acoust. Soc. Amer.*, 13, *pp.* 234–243, *Jan.*, 1942.—[Abstr. 703 B (1942)].

1265 535.214

Pressure of radiation in moving system. IVES, H. E. *J. Opt. Soc. Amer.*, 32, *pp.* 32–34, *Jan.*, 1942.—Discusses the rôle of radiation pressure in radiation measurements in a moving system. Both irradiation and radiation pressure are unaffected by motion of the entire system of source and receiver. The investigation confirms the result of Lorentz as to invariance of irradiation in a system of co-moving source and receiver to the first order of v/c, extends it to all orders, and eliminates the variation of radiation pressure with velocity. A. H.

1266 535.24 : 621.326.794

Practical photometry of fluorescent lamps and reflectors. BAUMGARTNER, G. R. *Illum. Engng, N.Y.*, 36, *pp.* 1340–1353, *Dec.*, 1941.—[Abstr. 680 B (1942)].

1267 535.243

Spark spectrographic analysis of commercial tin. SCRIBNER, B. F. *J. Res. Nat. Bur. Stand., Wash.*, 28, *pp.* 165–188, *Feb.*, 1942.—A procedure is described for the simultaneous spectrographic determination of Sb, As, Bi, Cd, Cu, In, Fe, Pb, Ag and Zn in Sn metal of commercial grades. The preparation of standards and samples by chill-casting of Sn in open moulds and in evacuated tubes is described. The characteristics of the Sn spark under varied operating conditions are discussed in connection with the selection of optimum conditions of excitation. Application of the step sector provides a means of extending the range of line-intensity measurements with the microphotometer as well as for plate calibration. Rapid reduction of the photometric measurements to intensities is made by a modified graphical calculator. The shapes of the analytical curves derived from measurements on Sn standards are compared, and deviations from the ideal case are discussed. Repeated determinations on homogeneous samples show a standard deviation of from 1·0 to 2·5%. Single determinations in routine analysis are estimated to fall within 5% of the actual conc., with few exceptions. The analyses are carried out on groups of 6 samples in a working time of 5 min. per determination.

See Abstr. 1321 535.3 : 537.531

See Abstr. 1322, 1323 535.3 : 548 : 537.531

1268 535.321

Determination of the refractive index of a liquid. MAY, A. *Amer. J. Phys.*, 10, *pp.* 50–51, *Feb.*, 1942.

See Abstr. 1361 535.33 : 522.6 : 77 : 539.371

1269 535.337 : 541.6

Raman spectrum of mercuric chloride in relation to its structure. RAO, K. V. K. *Proc. Indian Acad. Sci.* A, 14, *pp.* 521–528, *Nov.*, 1941.—Raman spectra in solid, liquid, gaseous and dissolved states, are obtained. Three l.f. lines, obtained in the solid state, are observed for the first time and explained as due to lattice oscillations. The principal Raman line occurs in the same position in the gaseous and dissolved states. The constancy of the Raman frequency in all states of aggregation is characteristic of non-polar molecules. It is concluded that $HgCl_2$ is non-polar and therefore a linear molecule. Study of the polarization characters of the Raman lines in the liquid state reveals that both Raman lines are polarized. Occurrence of the 2 lines and their polarization characters are explained on the basis of a linear structure. The strong line 314 cm.$^{-1}$ is attributed to the total symmetric oscillation and 377 cm.$^{-1}$ explained as the overtone of the forbidden frequency. A. H.

1270 535.338

The molecular vibrations and infra-red spectrum of acetaldehyde. THOMPSON, H. W., AND HARRIS, G. P. *Trans. Faraday Soc.*, 38, *pp.* 37–46, *Feb.–March*, 1942.

1271 535.338

A remarkable green-line source. KAPLAN, J. *Nature, Lond.*, 149, *p.* 273, *March* 7, 1942.

1272 535.338

Raman spectra of compounds in the gaseous and liquid states. NIELSEN, J. R., AND WARD, N. E. *J. Chem. Phys.*, 10, *pp.* 81–87, *Feb.*, 1942.—An apparatus for exciting the Raman spectra of gases and liquids at temperatures up to 300°C. is described. Raman spectra of various compounds were photographed in the liquid and the vapour state with a liquid-prism spectrograph of speed f : 2·9 and linear dispersion 27 Å/mm. at 4 400 Å. The spectra of *n*-pentane, *n*-hexane and deuterium oxide, were photographed with 2 537 Å excitation. The change in the Raman frequencies with the state of aggregation is different for different vibrations and varies greatly from compound to compound. The perpendicular bands of the symmetrical-top molecules are less diffuse in the liquid than in the gas. The other bands are equally sharp.

1273 535.338

Systematics in the vibrational spectra of the halogen derivatives of methane. WU TA-YOU. *J. Chem. Phys.*, 10, *pp.* 116–124, *Feb.*, 1942.—On considerations of the symmetry and the approx. nature of the vibrations, the observed infra-red and Raman frequencies of the halogen derivatives of methane are classified and their transitions in passing from one molecule to another in the series CH_4–CH_3X–CH_2XY–CH_2X_2–CHX_2Y–CHX_3–CX_4 are given. A potential function of the valence-force type containing 6 constants is suggested for CH_2X_2 and the frequency equations given.

1274 535.338 : 536.46

The spectra of chilled hydrocarbon flames. GAYDON, A. G. *Proc. Roy. Soc. A*, 179, *pp.* 439–450, *Feb.* 27, 1942.—The spectrum of the outer cone of hydrocarbon flames struck back in a water-cooled steel burner shows the hydrocarbon flame bands in the ultra-violet known as the ethylene bands. Under suitable conditions these are strong, being almost the sole feature of the spectrum. The occurrence of these bands is associated with the formation of a peroxide, probably an alkyl peroxide. The bands are not necessarily associated with the presence of aldehydes in the interconal gases. Catalysts have little effect. A brief discussion on the nature of the emitter of the hydrocarbon flame bands is given.

1275 535.338 : 541.571

Spectroscopic evidence of hydrogen bonds in hydrogen peroxide and hydrazine. GIGUÈRE, P. A. *Trans. Roy. Soc. Can.*, 35, *pp.* 1–8, *May*, 1941.—Measurements are made of the infra-red absorption spectra of H_2O_2 and hydrazine. A. H.

See Abstr. 1413 535.338 : 541.6

1276 535.34

A general law of diminution of light intensity in natural waters and the percent of diffuse light at different depths. WHITNEY, L. V. *J. Opt. Soc. Amer.*, 31, *pp.* 714–722, *Dec.*, 1941.—The incident light is supposed to consist of sunlight from a particular angle, with a proportion of skylight. Allowing for light lost by surface reflection, this mixed direct light is exponentially attenuated with depth. Such a law only holds for small depths, because of the modification in the angular distribution of the direct light. With increase in depth the direct becomes less important than the light arising by scattering from the direct light, and this diffuse light tends to a limiting angular distribution, which is determined by true absorption and scattering. Thus a second exponential law of attenuation is assumed for the diffuse light. On this basis the author derives a general law of attenuation, which takes account of the progressive transfer of light from the direct to the diffuse components. Calculations are made for the waters of two Wisconsin lakes. W. S. S.

1277 535.342

The l.f. fundamental band of ethane at 12 μ. OWENS, R. G., AND BARKER, E. F. *J. Chem. Phys.*, 10, *p.* 146, *Feb.*, 1942.

1278 535.342 : 523.77

Absolute *f*-values for lines of Fe I. KING, R. B. *Astrophys. J.*, 95, *pp.* 78–81, *Jan.*, 1942.—Absolute *f*-values have been measured by the method of total absorption for 12 lines in 2 multiplets, a^5D–z^5F^0 and a^5D–z^5D^0, from the ground state of Fe I [Abstr. 537 (1938)]. A factor, $1{\cdot}85 \times 10^{-4}$, is derived by which to multiply the relative *f*-values for Fe I published earlier, to place them on an abs. scale.

1279 535.342 : 539.133

The infra-red absorption spectra of ethylene and tetra-deutero-ethylene under high resolution. GALLAWAY, W. S., AND BARKER, E. F. *J. Chem. Phys.*, 10, *pp.* 88–97, *Feb.*, 1942.—The fine structure of several infra-red absorption bands of C_2H_4 and C_2D_4 have been resolved. From the rotational constants so found, the C–C and C–H distances in this molecule were calculated to be 1·353 and 1·071 Å, and the H–C–H angle to be 119° 55′. An assignment of fundamental frequencies has been made.

1280 535.343

The ultra-violet absorption spectra of the monomethylchrysenes. BRODE, W. R., AND PATTERSON, J. W. *J. Amer. Chem. Soc.*, 63, *pp.* 3252–3255, *Dec.*, 1941.

1281 535.343.3

Absorption of polysubstituted benzene derivatives. SKLAR, A. L. *J. Chem. Phys.*, 10, *pp.* 135–144, *Feb.*, 1942.—The intensification, by non-chromophoric substitutions, of the forbidden, $^1A_{1g} \rightarrow {}^1B_{2u}$, transition in benzene is due to the unsymmetrical distortion of the ring by the normal vibrations and to the transition moment produced at the equilibrium position by the migration of charge from the substitution into the ring or vice versa. The latter effect is treated by the method of antisymmetrical molecular orbitals. The rules for combining transition moments due to the various groups in a polysubstituted benzene are calculated.

1282 535.371

Spectra of lipoid fractions from human non-cancerous and cancerous tissue. PENN, H. S. *J. Chem. Phys.*, 10, *pp.* 145–146, *Feb.*, 1942.

1283 535.41 : 530.12

Interference phenomena with a moving medium. II. IVES, H. E., AND STILWELL, G. R. *J. Opt. Soc. Amer.*, 32, *pp.* 25–31, *Jan.*, 1942.—Continuing earlier work [Abstr. 574 (1941)] experimental apparatus and methods have been developed by which the profiles of ripples on a mercury surface can be photographed, with the surface in motion relative to the source or to a mirror. It is found that in all cases the amplitudes of vibration remain invariant with motion of the medium. The factors from which this behaviour derives are analysed and the effects of the Fitzgerald and Larmor–Lorentz contractions are discussed. A. H.

1284 535.557 = 3

Some investigations on stream double refraction. SNELLMAN, O., AND BJÖRNSTÄHL, Y. *Kolloid Beih.*, 52, *pp.* 403–466, 1941.—The methods for measuring the double refraction and the determination of the principal directions of oscillation are discussed. A statistical theory of orientation is given and the relations between rotary Brownian movement and diffusion are considered. A theory of the optical problem is derived and the index ellipsoid is constructed for optically biaxial particles. The effect of an asymmetric action surface and the behaviour of polydisperse substances are investigated. The dependence of extinction angle and phase difference on gradient are dealt with theoretically and experimentally, and graphs are given for this functional relation. In investigating pure liquids, colloidal solutions are considered as models. R. N.

1285 535.557 = 3

On stream double refraction in absorbent active solutions. BJÖRNSTÄHL, Y. *Kolloid Z.*, 97, *pp.* 46–53, *Oct.*, 1941.—The theory given for non-active substances [Abstr. 1284 (1942)] is now generalized to comprise active substances, and the const. of the oscillations are determined analytically and geometrically under the assumption that the const. of the double-refractive medium are known. If activity is changed by the flow of the medium, additional experiments are required for determining the const. R. N.

1286 535.557 : 541.65 = 3

Stream double refraction of some pectins. SNELLMAN, O., AND SÄVERBORN. *Kolloid Beih.*, 52, *pp.* 467–472, 1941.—For determining the molecular structure of pectins the position of the extinction angle, the amount of double refraction and their dependence on the gradient in stream double refraction, are investigated. [See Abstr. 1284 (1942)]. R. N.

1287 535.6 : 628.9

Interpretation of spectral distribution data in practical colour applications. OETTING, R. L., AND AMICK, C. L. *Illum. Engng, N.Y.*, 36, *pp.* 1369–1390; *Disc.*, 1390–1396, *Dec.*, 1941.—The fundamental aspects connecting the spectral qualities of fluorescent and other light sources with the final appearance of coloured material under their illumination are developed. The meaning and methods of plotting spectral distribution data are explained with diagrams. Reflectance curves for the 62 coloured samples in the supplementary colour chart are presented to enable each curve and sample to be viewed simultaneously as an aid to those engaged in lighting design to interpret reflectance curves. H. G. S.

1288 535.6 : 628.97

Improved vision in machine-tool operations by colour contrast. BRAINERD, A. A., AND DENNING, M. *Illum. Engng, N.Y.*, 36, *pp.* 1397–1409; *Disc.*, 1409–1413, *Dec.*, 1941.—Investigations to determine the effect of colour and brightness of surrounding surfaces on the utilization of light for improved seeing in machine-tool operations are described. The light falling on the working surfaces and the light reflected are photometered. The important surfaces of each machine, a small punch press and a power shear, are divided into zones 1 ft.^{2} in area. The zonal readings are taken with the Macbeth illuminometer, the illumination on the machine surface measured in f.c. and the brightness determined in f.c. reflected back from the machine, for the original colour, dark grey, and for the colours chosen for the test, under both incandescent and Hg lighting. With a well-designed lighting system accuracy of seeing is increased by a proper selection of the colour and brightness of the machine parts, accident hazards are decreased, production increased, and more comfortable working conditions produced. H. G. S.

See Abstr. 1183 535.62 : 515.1

1289 535.7

Intrinsic brightness as a factor in discomfort from glare. LUCKIESH, M., AND MOSS, F. K. *J. Opt. Soc. Amer.*, 32, *pp.* 6–7, *Jan.*, 1942.—Experiments are described in which the rate of blinking was recorded while the subject was reading, when a glare source was placed at 35° from the line of vision. It was found that the rate of blinking increased significantly as the brightness of the glare source was increased and its area reduced to keep the glare illumination constant at the observer's eye. Using the rate of blinking as a criterion for ease of seeing, the results are discussed in relation to the design of satisfactory lighting installations. W. D. W.

1290 535.7

Quantum relations of vision. HECHT, S. *J. Opt. Soc. Amer.*, 32, *pp.* 42–49, *Jan.*, 1942.—The paper reviews attempts made to determine the min. energy required to produce a visual effect and discusses the physiological and physical conditions of observation necessary to secure significant results. Experiments are described in which the test field subtended 10′ of arc and was viewed at a point on the retina situated 20° from the fovea on the temporal side. The field was illuminated by monochromatic light of wavelength 0·51 μ, the exposure time being 0·001 sec. The results showed that between 58 and 148 quanta were required to produce a visible effect and, when allowance had been made for absorption in the optic media and in visual purple, this corresponded to between 5 and 14 quanta actually absorbed by the visual purple of the retina. From another set of experiments on the frequency with which the flash was seen as its intensity was varied, it was deduced that the number of quanta absorbed was between 5 and 7. W. D. W.

1291 535.7 : 628.9

The anatomy of visual efficiency. LOGAN, H. L. *Illum. Engng, N.Y.*, 36, *pp.* 1057–1083; *Disc.*, 1083–1108, *Dec.*, 1941.—The principal causes of ocular discomfort are analysed. Owing to their nature they are not amenable to engineering treatment. A normal person will experience ocular comfort under optimum visibility conditions, of which the factors are defined and determined. A technique embodying the utilization of these factors in designing artificially lighted fields of view is described. H. G. S.

1292 535.767

A neural mechanism for discrimination. IV. Monocular depth perception. STANTON, H. E. *Bull. Math. Biophys.*, 3, *pp.* 113–120, *Dec.*, 1941.—The mechanism for discrimination described by Householder is applied to the problem of monocular depth perception and the Weber ratio is determined. The ratio obtained varies as a small positive power of the distance for nearby objects, while for distant objects it is indicated that discrimination is relatively impossible.

1293 535.81 : 621.3.032.73

A new chemical method of reducing the reflectance of glass. NICOLL, F. H. *RCA Rev.* [*Radio Corp. Amer.*], 6, *pp.* 287–301, *Jan.*, 1942.—A new chemical method of reducing the reflectance of glass is described. It produces a tough hard film of very low reflecting power. The treatment involves exposure to HF vapour and is applicable to large sheets of glass. The process requires neither vacuum nor expensive equipment and is suitable for many optical glasses. Photographs are given of several examples of applications, including c.r.-tube faces, ground-glass screens on cameras, and glass covers for photographs and pictures.

1294 535.88

Projector for stereoscopic pictures. FISHER, D. J. *Amer. J. Phys.*, 10, *pp.* 46–49, *Feb.*, 1942.—Describes the mechanical construction of a stereoscopic projector made up from two single 2 × 2 in. projectors. The two pictures are projected through polaroid film on to a screen sprayed with aluminium paint and are viewed through polaroid "spectacles." With a 500 W lamp satisfactory illumination is obtained with a throw of 20 ft. J. W. T. W.

See Abstr. 1241 536.1 : 532.511

1295 536.21

Properties of heat-insulating materials. ALLCUT, E. A. *Engng J. Can.*, 24, *pp.* 514–524, *Nov.*, 1941.—The physical structures of various heat-insulating materials are discussed and data are given for their thermal conductivities and their permeability to air. Apparatus for determining the conductivity of materials in the form of slabs or of steam-pipe coverings are described. The practical applications of

such materials and the insulation of buildings is dealt with, and attention is directed towards the possibility of saving fuel by taking advantage of solar radiation and of heat stored in the structure of the building itself. An appendix deals with the microscopic mensuration of fibrous materials available for heat insulation. R. W. P.

1296 536.21 : 621.315.613.7

Thermal and electrical properties of bitumastic compounds containing quartz sand. JACKSON, W. *Phil. Mag.*, 33, *pp.* 81–89, *Feb.*, 1942.—[Abstr. 647 B (1942)].

1297 536.23 = 3

Heat transfer in turbulent flow. ECKERT, E. *VDI [Z. Ver. dtsch. Ing.]*, 85, *pp.* 581–583, *June* 28, 1941.—A report on recent work for developing Prandtl's conception. While Prandtl's formula is derived under the assumption that flow is laminar near the walls and turbulent at the centre, recent investigations insert a transitional zone in which the turbulent heat exchange at the centre gradually becomes conductive in the laminar range. A dimensionless heat-transfer number is derived, and its calculated and measured values are in agreement. A short bibliography is given. R. N.

See Abstr. 1317 536.4 : 537.523.5 : 621.365.2

1298 536.41

The thermal expansion of pure metals. II. Molybdenum, palladium, silver, tantalum, tungsten, platinum and lead. NIX, F. C., AND MACNAIR, D. *Phys. Rev.*, 61, *pp.* 74–78, *Jan.* 1 *and* 15, 1942.—[See Abstr. 118 (1942)].

See Abstr. 1426 536.41 : 531.7 : 548

1299 536.423

Vapour pressures of monatomic vapours. DITCHBURN, R. W., AND GILMOUR, J. C. *Rev. Mod. Phys.*, 13, *pp.* 310–327, *Oct.*, 1941.—Experimental methods of determining the v.p. of monatomic vapours are described and discussed, and the results of different workers are correlated. The theory of the v.p. equation is considered with special reference to the Nernst heat theorem. A. J. M.

See Abstr. 1274 536.46 : 535.338

See Abstr. 1304 536.531 : 536.621

1300 536.531 : 621.317.39

Intercomparison of platinum resistance thermometers between — 190° and 445°C. HOGE, H. J., AND BRICKWEDDE, F. G. *J. Res. Nat. Bur. Stand., Wash.*, 28, *pp.* 217–240, *Feb.*, 1942.—[Abstr. 666 B (1942)].

1301 536.55 : 541.182.6 = 3

A colloidal heat indicator. LIESEGANG, R. E. *Kolloid Z.*, 97, *pp.* 96–99, *Oct.*, 1941.—The author describes an improved heat indicator consisting of a mixture of 13·5 cm.^{3} of an aqueous solution containing 20% of Na_2SO_3 and a solution of 3 g. novocain in 10 cm.^{3} water. In order to obtain a conc. gradient, 4 g. of KBr are put on the bottom of the test glass before the mixture is filled in and the glass is given a 5 days' rest. At 26°C. the mixture is clear. When heated slowly, Lloyd's layers are formed which disappear by cooling down. A tentative explanation is given. R. N.

1302 536.6

The heat capacity, entropy, and heats of transition, fusion and vaporization of dimethylacetylene. Free rotation in the dimethylacetylene molecule. YOST, D. M., OSBORNE, D. W., AND GARNER, C. S. *J. Amer. Chem. Soc.*, 63, *pp.* 3492–3496, *Dec.*, 1941.

1303 536.6

The heat capacity, entropy, heats of fusion and vaporization and vapour pressure of fluorotrichloromethane. OSBORNE, D. W., GARNER, C. S., DOESCHER, R. N., AND YOST, D. M. *J. Amer. Chem. Soc.*, 63, *pp.* 3496–3499, *Dec.*, 1941.

See Abstr. 1383 536.6 : 541.132

1304 536.621 : 536.531

A low-temperature adiabatic calorimeter. The calibration of the platinum resistance thermometers. YOST, D. M., GARNER, C. S., OSBORNE, D. W., RUBIN, T. R., AND RUSSELL, JR., H. *J. Amer. Chem. Soc.*, 63, *pp.* 3488–3492, *Dec.*, 1941.—A precision adiabatic low-temperature calorimeter is described which is simple to construct and operate, and which requires only 2 l. of liquid H for a complete series of heat-capacity measurements in the range 14°–90° K. A calorimeter for v. p. and heats of vaporization is also described. The calibration of a set of Pt resistance thermometers over range 14° K. to 200°C. is described.

1305 536.65

Nitromethane: the heat capacity of the gas, the vapour density, and the barrier to internal rotation. PITZER, K. S., AND GWINN, W. D. *J. Amer. Chem. Soc.*, 63, *pp.* 3313–3316, *Dec.*, 1941.

1306 536.658 = 3

On the difference of the heats of adsorption of ortho- and para-hydrogen. CREMER, E. *Z. phys. Chem. B*, 49, *pp.* 245–246, *July*, 1941.—The calculation of the heats of adsorption of ortho- and para-hydrogen on solid O, based on Langmuir's isotherm, shows a considerable difference (90 cal.) between the 2 values. This is explained by a hindrance effected by neighbouring molecules of the adsorbent on the rotation of the ortho-molecules. [See Abstr. 2184 (1940)].

R. N.

1307 536.66 : 541.126

Theoretical calculations for explosives. I. Explosion temperatures and gaseous products and the effects of changes in carbonaceous material. BROWN, F. W. *Techn. Pap. U.S. Bur. Min. No.* 632, [21 *pp.*], 1941.—Thermodynamic data are assembled and tabulated for the calculation of explosion temperatures and gaseous products in the detonation of solid and liquid explosives. Explosion temperatures and gaseous products are calculated for a typical high-ammonium-nitrate permissible explosive and a typical 60% gelatin dynamite. The effects of the following factors are discussed: (1) Wide variations in oxygen balance, obtained by changing the amount of wrapper; (2) variations in the ratio of C to H for the same O balance, obtained by substituting pure C for wrapper; (3) variations in pressure or density of explosive.

See Abstr. 1193 536.714 : 518.4

1308 536.758

Statistical thermodynamics of rubber. WALL, F. T. *J. Chem. Phys.*, 10, *pp.* 132–134, *Feb.*, 1942.—The entropy change for the stretching of rubber is calculated by statistical methods, neglecting intermolecular attractions and deformation of bonds and bond angles. The calculation involves the probability of finding the system with a given distribution of molecular con-

figurations. An equation of state relating the tension, length and temperature, of a rubber band is then derived. A discussion of the applicability and the limitations of the theory is presented.

1309 536.773

Pressure dependence of the equilibrium constant of ammonia. FUCHS, K. *Proc. Roy. Soc. A.*, 179, *pp.* 433–438, *Feb.* 27, 1942.—The pressure dependence of the equilibrium const. of a slightly imperfect gas is calculated. At sufficiently high temperatures, the const. occurring in the formula can be expressed in terms of the van der Waals const. The latter can be obtained from the second virial coefficients. Numerical results for ammonia give good agreement,

1310 537.222.2 : 621.3.032

The field of electrets in the presence of gaseous ions. GEMANT, A. *Phys. Rev.*, 61, *pp.* 79–83, *Jan.* 1 *and* 15, 1942.—It is shown by computation that the field of electrets ought to be completely shielded by the ions present in the atmosphere. Experimental evidence is in apparent contradiction with this conclusion. The use of electrets in discharge tubes or in high-vacuum tubes is suggested. The making of electrets of relatively high softening point appears to be the next step in research. [See Abstr. 4684 (1939)].

1311 537.226.1

Dispersion and absorption in dielectrics. II. D.C. characteristics. COLE, K. S., AND COLE, R. H. *J. Chem. Phys.*, 10, *pp.* 98–105, *Feb.*, 1942.—The transient current as a function of the time, t, after application of a unit const. p.d. has been calculated from the expressions given previously [Abstr. 1344 (1941)]. For times $<< \tau_0$ the time dependence is of the form $(t/\tau_0)^{-\alpha}$, and for times $>> \tau_0$ it is of the form $(t/\tau_0)^{-(2-\alpha)}$. The transition occurs for the range in which t is comparable with τ_0. The total absorption charge, which is the integral of the exact expression, is always finite.

See Abstr. 1341 537.226.1 : 539.133

1312 537.226.2 : 541.121

The equilibrium diagram of the system carbon-tetrachloride–*t*–butyl-chloride as revealed by dielectric-constant measurements. CONNER, W. P., AND SMYTH, C. P. *J. Amer. Chem. Soc.*, 63, *pp.* 3424–3428, *Dec.*, 1941.—The dielectric const. of a continuous series of solid solutions of CCl_4 and *t*-butyl chloride have been measured over a wide range of temperature at frequencies of 0·5, 5 and 50 kc./s. in order to study the effect of CCl_4 upon the rotation of the *t*-butyl chloride molecules. The temperature of the rotational transition of each component is lowered by the presence of the other component. The dielectric-const. data are used to construct an equilibrium diagram for the system. Examination of the solid solutions with a polarizing microscope showed that their lattices were isotropic as long as the molecules possessed freedom of rotation comparable to that in the liquid. The cessation of molecular rotation caused the lattices to become anisotropic.

1313 537.311.33 : 538.632

The electrical conductivity of titanium dioxide. EARLE, M. D. *Phys. Rev.*, 61, *pp.* 56–62, *Jan.*1 *and* 15, 1942.—Experiments on TiO_2 show that it is an electronic semi-conductor in which the current carriers are free electrons, as contrasted with the hole conduction of the other type of semi-conductor. It is found that the variation with oxygen pressure is that which would be expected if the TiO_2 decomposes in the following manner: $TiO_2 \rightarrow Ti^+ + O_2 + e^-$. The deviation of the curves at l.p. is due to impurities. The variation of conductivity with temperature is represented by $\sigma = Ae^{-\epsilon/kT}$. The activation energy ϵ is 1·7 eV. The ionic conductivity is less than that which can be measured in these experiments. Measurements of the Hall effect show that the m.f.p. for the conduction electrons is small.

1314 537.312.8 : 545.721 = 3

On oxygen determination by physical means. REIN, H. *Schr. dtsch. Akad. Luftf.-Forsch.*, 11, 1940. *Abstr. in VDI* [*Z. Ver. dtsch. Ing.*], 84, *p.* 580, *Aug.* 10, 1940.—For determining the O contents in the atmosphere in the cabin of high-flying aircraft or submerged submarines, a new method has been developed, making use of the change of heat conductivity of a paramagnetic gas subjected to a magnetic field. Two Pt–Ir wires of 0·01 mm. dia. and 3 cm. length enclosed in cells are heated by a current and their resistances are compared by a Wheatstone bridge. Both heating wires lie in the flow of the gas to be tested. If one of the cells is magnetized the heat conductivity is reduced and the galvanometer shows the change of resistance. It is calibrated according to the O conc. and the accuracy is claimed to be 0·01%. R. N.

1315 537.363

Electrophoresis of the chlorophyll-protein complex. FISCHMAN, M., AND MOYER, L. S. *Science*, 95, *pp.* 128–129, *Jan.* 30, 1942.

1316 537.523.2

Angular distribution of current from a point in hydrogen. BENNETT, W. H. *Phys. Rev.*, 61, *pp.* 53–56, *Jan.* 1 *and* 15, 1941.—The angular distribution of current of electrons from a sharp point in hydrogen is measured for various currents and sizes of wire. Evidence is obtained for the critical effect of the potential drop in the ionization sheath. [See Abstr. 261, 427 (1941)].

1317 537.523.5 : 536.4 : 621.365.2 = 3

Boiling point of carbon and the high-current arc. PODSZUS, E. *Z. Phys.*, 116, 5–6, *pp.* 352–358, 1940.—Even without long anode flames, an emission of light is observed from the vapour at the arc between pure carbons as intense as described by Finkelnburg. This is accompanied by an increase of the temperature of the crater. Examples are given of arcs of high current with increasing characteristic curves. All forms of the electric arc, at not too small pressures, can be uniformly interpreted if the external conditions are taken into account (structure of the anode, convection, motion, cooling, etc.). [See Abstr. 771 (1942)].

O. O.

1318 537.523.5 : 621.325.1 = 3

The potential drop at the anode, the decomposition of the anode, and the theory of the high-current arc between carbon electrodes. FINKELNBURG, W., AND SCHLUGE, H. *Z. Phys.*, 116, 3–4, *pp.* 214–234, 1940.—Discusses the rising characteristic curve of the arc, the anamalous anode drop, and decomposition of the anode by burning and evaporating, theory of the anomalous anode drop, and of the mechanism of the processes at the anode is given. The

sp. intensity of the light and the negative pointed flame are discussed. O. O.

1319 537.525 : 621.314.652 = 3

On the effect of electrically controlled grids on space charge. SCHUMANN, W. O. *Arch. Elektrotechn.*, 35, *pp.* 437–444, *Aug.* 25, 1941.—[Abstr. 643 B (1942)].

1320 537.525.5 : 621.314.652 = 3

Control of a mercury discharge by collaboration of grid and anode. MANZ, G. *Arch. Elektrotechn.*, 35, pp. 567–590, *Nov.* 17, 1941.—[Abstr. 644 B (1942)].

1321 537.531 : 535.3

Scattering of polarized X-rays by ferromagnetic substances. RODGERS, E. *Phys. Rev.*, 61, *pp.* 35–37, *Jan.* 1 *and* 15, 1942.—It is shown that, if h.f. polarized X-rays are scattered by some substance, the total intensity of the scattered rays should be altered by anything leading to special orientations of the electron spins of the scattering electrons. Some experiments are described in which attempts were made to detect the effect on intensity due to changes in spin orientations in ferromagnetic substances when these substances are magnetized. No effects were observed. It is shown that an attempt to reconcile the results of these experiments with those of gyromagnetic experiments leads to orientations of the spin giving the spin magnetic quantum numbers + 1/2 and − 1/2.

1322 537.531 : 535.3 : 548

Reflection and scattering of X-rays with change of frequency. I. Theoretical. II. Experimental. RAMAN, C. V. *Proc. Roy. Soc. A*, 179, *pp.* 289–314, *Jan.* 23, 1942.—Describes the author's theory of quantum reflection and quantum scattering of X-rays, with experimental tests. The additional spots visible in Laue photographs are stated to arise not from the elastic solid vibrations of the lattice but from the excitation of the infra-red or characteristic h.f. vibrations by the X-ray photons. Several predicted phenomena are observed in the case of diamond, among which is the persistence of the reflections by the (111) planes of diamond with undiminished intensity at the temperature of liquid air. Contrary results obtained by other workers at the temperature of liquid air are considered to be untrustworthy owing to the technique adopted. [See Abstr. 1090 (1942)]. J. T.

1323 537.531 : 535.3 : 548

Thermal scattering of X-rays in crystals. WEIGLE, J., AND SMITH, C. S. *Phys. Rev.*, 61, *pp.* 23–34, *Jan.* 1 *and* 15, 1942.—A theoretical study of the effects of the thermal motion of the atoms of a cubic monatomic crystal on the diffraction of X-rays, based on the representation of these effects in the reciprocal lattice. It is not claimed that the results are new but that they are a simple representation of the results of Faxen, Waller and Zachariasen. The problem of scattering from waves of large amplitude is also considered. J. T.

1324 537.531.9

On the photodisintegration of beryllium and deuterium. MYERS, F. E., AND ATTA, L. C. VAN. *Phys. Rev.*, 61, *pp.* 19–22, *Jan.* 1 *and* 15, 1942.—High-voltage X-rays have been used to redetermine the thresholds for the photodisintegration of Be and D nuclei, giving 1·627 ± 0·010 MV and 2·183 ± 0·012 MV, respectively. The ratio of the 2 cross-sections at 15 kV above the threshold voltage is approx. 10. The angular distribution of the neutrons from the photodisintegration of D has been investigated with X-rays of 2·43 eMV max. energy and found to be approx. isotropic. The ratio of the photomagnetic to photo-electric cross-section is estimated to be 6 to 1.

1325 537.533.72 : 621.385.833 = 3

The effect of the p.d. on the super-microscopic image. BORRIES, B. VON, AND RUSKA, E. *Z. Phys.*, 116, 3–4, *pp.* 249–256, 1940.—[Abstr. 691 B (1942)].

1326 537.533.72 : 621.385.833 = 3

Technical improvements in the formation of images of surfaces irradiated with electrons. RUSKA, E., AND MÜLLER, H. O. *Z. Phys.*, 116, 5–6, *pp.* 366–369, 1940.—[Abstr. 692 B (1942)].

1327 537.533.72 : 621.385.833 = 3

Higher resolving power at the formation of images of surfaces by the super-microscope. BORRIES, B. VON. *Z. Phys.*, 116, 5–6, *pp.* 370–378, 1940.—[Abstr. 693 B (1942)].

1328 537.533.74

Single scattering of fast electrons. BLEULER, E., SCHERRER, P., AND ZÜNTI, W. *Phys. Rev.*, 61, *p.* 95, *Jan.* 1 *and* 15, 1942.

1329 537.534.74

Scattering of protons by deuterium. TASCHEK, R. F. *Phys. Rev.*, 61, *pp.* 13–17, *Jan.* 1 *and* 15, 1942.—Scattering of protons by D has been studied in the energy interval between 200 kV and 300 kV and as a function of angle between 20° and 90°. The ratio of observed scattering to that expected on the basis of Rutherford's formula is found to differ appreciably from unity and to increase, both with increasing energy and angle.

1330 537.564

Ionization of gases by collisions of their own accelerated atoms and molecules. BERRY, H. W., VARNEY, R. N., AND NEWBERRY, S. *Phys. Rev.*, 61, *pp.* 63–64, *Jan.* 1 *and* 15, 1942.—Apparatus for producing fast neutral atom beams and measuring ionization caused by collisions of these atoms with others is described, together with preliminary results on A and N. The ionization of A atoms appears to be similar to ionization by electron collisions in that the efficiency reaches a peak and falls off again with increasing speed. Ionization of N by neutral N was observed, but the nature of the ionization function was not positively established.

1331 537.591

Cosmic-ray theory. ROSSI, B., AND GREISEN, K. *Rev. Mod. Phys.*, 13, *pp.* 240–309, *Oct.*, 1941.—The authors consider the fundamental processes involved, including collision processes, the Compton effect, radiation processes, pair production and scattering. Shower theory is dealt with. A. J. M.

1332 537.591.1

Electrical and anomalous scattering of mesotrons. SHUTT, R. P. *Phys. Rev.*, 61, *pp.* 6–13, *Jan.* 1 *and* 15, 1942.—The scattering of mesotrons in Pb has been studied from photographs obtained without a magnetic field in a large counter-controlled cloud chamber, containing Pb plates of 2 different thicknesses. Results for the scattering in 5 cm. plates at

angles $> 4°$, when compared with that in a 1 cm. plate, do not agree with the theory of Williams. The average cross-section for this anomalous large-angle scattering agrees with results obtained by Code. Calculations on the basis of interaction between mesotrons and nuclei, and a Hartree energy distribution, give agreement with the cross-section when the mesotron spin is $\frac{1}{2}$. A spin of 1 does not appear possible. It still remains possible that the anomalous scattering is not due to the mesotron component of cosmic rays but to the proton component. A. J. M.

1333 537.591.1

A photographic method of estimating the mass of the mesotron. Bose, D. M., and Choudhuri, B. *Nature, Lond.*, 149, *p.* 302, *March* 14, 1942.

1334 537.591.3

Absorption of extensive atmospheric showers of cosmic rays in air and lead. Auger, P., and Daudin, J. *Phys. Rev.*, 61, *pp.* 91–92, *Jan.* 1 *and* 15, 1942.

1335 537.591.5

Diurnal variation of extensive showers. Auger, P., and Daudin, J. *Phys. Rev.*, 61, *p.* 95, *Jan.* 1 *and* 15, 1942.

1336 538.214

The change in magnetic susceptibility of nickel disalicylaldehyde on hydrogenation. Fobes, M. A., and Tyson, Jr., G. N. *J. Amer. Chem. Soc.*, 63, *p.* 3530, *Dec.*, 1941.

1337 538.22

Magnetism of strontium. Rao, S. R., and Savithri, K. *Proc. Indian Acad. Sci. A*, 14, *pp.* 584–592, *Nov.*, 1941.—The sp. magnetic susceptibility of Sr has been determined by the Curie method. The value at 30°C. is found to be $+ 1{\cdot}05 \times 10^{-6}$. A thermomagnetic investigation of the metal showed the sp. susceptibility to increase from $1{\cdot}02 \times 10^{-6}$ at 0°C. to $1{\cdot}09 \times 10^{-6}$ at about 65°C. The susceptibility decreased thereafter to $+ 0{\cdot}73 \times 10^{-6}$ at 260°C.

1338 538.221

Anisotropy of ferromagnetic powder particles. Benedikt, E. T. *J. Appl. Phys.*, 13, *pp.* 105–109, *Feb.*, 1942.—Measurements of the magnetic moment of sediments of ferromagnetic particles deposited in a magnetic field show that the particles are magnetically anisotropic. The dependence of this anisotropy on the magnetic field is investigated for sediments prepared under different conditions, and its probable origin discussed.

See Abstr. 1313 538.632 : 537.311.33

1339 539.11

The interaction between a molecule and a metal surface. Prosen, E. J. R., and Sachs, R. G. *Phys. Rev.*, 61, *pp.* 65–73, *Jan.* 1 *and* 15, 1942.—The interaction is discussed from the point of view of the perturbation theory. The interaction energy is found to be inv. $\propto$ distance, R, between metal and molecule if the electron degeneracy in the metal is not taken into account, and to $R^{-2} \log R$ if this degeneracy is taken into account. The application of the perturbation theory as given here is limited to values of R of the order of magnitude of the Bohr radius because of the neglect of the electron-electron interaction.

See Abstr. 1427 539.11 : 548

1340 539.13

The positions of the carbon atoms in austenite. Petch, N. J. *J. Iron Steel Inst.*, [13 *pp.*], 1942. *Advance copy.*—Direct X-ray evidence of the location of the C atoms in austenite has been obtained. They lie at the centres of the unit cells and at the midpoints of the edges, these positions being the centres of the largest spaces between the Fe atoms in the austenite structure. There is never enough C in solution for every one of these positions to be filled. The number of C atoms per unit cell varies from 0 for pure Fe to 0·32 for a 1·7% carbon steel, so that, at the most, only 1 possible position in 12 is occupied. Other theories of the structure of austenite are discussed.

See Abstr. 1279 539.133 : 535.342

1341 539.133 : 537.226.1

Anomalous dispersion of dipolar ions. Marcy 3rd, H. O., and Wyman, Jr., J. *J. Amer. Chem. Soc.*, 63, *pp.* 3388–3397, *Dec.*, 1941.—Relaxation times of amino acids, peptides etc., were investigated by an improved oscillographic method. Using transit time of the electrons, controlled by anode voltage, phase angles at u.h.f. are found, and, with observations of the oscillograph pattern, real and imaginary parts of the dielectric const. are determined. Relaxation times are calculated by the Debye theory. Observations at 115 Mc./s. give relaxation times in agreement with values calculated from Stokes' formula, assuming that the molecules are rigid spheres. It is concluded that the molecules orient as rigid bodies in the applied electric field, and that there is no internal rotation in either molecule in periods shorter than those corresponding to the critical frequencies. N. M. B.

See Abstr. 1429 539.155.2 : 548.7

1342 539.16.08

The quantitative determination of radium by a photographic method. Meyer, H. *Brit. J. Radiol.*, 15, *pp.* 85–91, *March*, 1942.—A simple apparatus is described which allows 3 exposures on the same strip of film, 1 from the specimen under assay and 2 with a standard preparation. Methods of developing the film are illustrated, with details of processing and measurement of the film density. B. J. L.

1343 539.16.08

The discharge mechanism of fast G–M counters from the deadtime experiment. Stever, H. G. *Phys. Rev.*, 61, *pp.* 38–52, *Jan.* 1 *and* 15, 1942.—The deadtime of a self-quenching counter is an insensitive time, of the order of 10^{-4} sec., between the time when a counter registers a count and the time at which it has recovered sufficiently to register another count. A method of measurement is shown. From theory it is possible to compute times associated with the deadtime. The check between theory and experiment is good. The theory involves the formation of a positive-ion space-charge sheath about the wire of the counter, this sheath expanding to the cylinder. It is also possible to study the lengthwise spread of that discharge. The discharge spread throughout the length of the counter, but the spread could be stopped by a small glass bead on the wire. This discovery led to the construction of a directional Geiger counter.

1344 539.16.08

Some discharge characteristics of self-quenching counters. Ramsey, W. E., and Hudspeth, E. L. *Phys. Rev.*, 61, *pp.* 95–96, *Jan.* 1 *and* 15, 1942.

1345 539.16.08

Directional properties of self-quenching counters. RAMSAY, W. E. *Phys. Rev.*, 61, *pp.* 96–97, *Jan* 1 *and* 15, 1942.

1346 539.164.9 : 539.166.9 : 539.185.9

The effect of ionizing radiations on the broad bean root. I. General notes. II. The lethal action of gamma-radiation. III. The lethal action of neutron radiation. *Brit. J. Radiol.*, 15, *pp.* 11–16, *Jan.*; 39–42, *Feb., and pp.* 72–76, *March*, 1942.—Deals with mortality dose curves of such beans irradiated by γ-rays, fast neutron rays, α-particles and X-rays. The lethal effect of α-radiation is described, the methods of irradiation used being detailed. Neutrons were generated by the impact of deuterium ions accelerated through a p.d. about 380 kV upon a target formed by a thin film of wax. The intensity of γ-rays simultaneously developed is estimated at less than 1 per 200 neutrons. Some X-rays were emitted from the top of the ion tube, 150 cm. above the specimens being irradiated. The relative efficiencies of γ-rays and neutrons in terms of mean lethal dose were in the ratio $8{\cdot}7 \pm 1{\cdot}6$.

B. J. L.

1347 539.165.8

A suggestion on the detection of the neutrino. KAN CHANG WANG. *Phys. Rev.*, 61, *p.* 97, *Jan.* 1 *and* 15, 1942.

See Abstr. 1346 539.166.9 : 539.185.9 : 539.164.9

1348 539.172.3

On the separation of nuclear isomers. COOPER, E. P. *Phys. Rev.*, 61, *pp.* 1–5, *Jan.* 1 *and* 15, 1942.—The fact that nuclear isomers can be separated chemically cannot be explained on the basis of the recoils involved. However, with *K* capture, or with internal conversion accompanying the isomeric transition, there is a mechanism for the separation. The positive charge built up by the Auger effect during the electronic readjustment is enough to cause molecular dissociation. To illustrate this, the probabilities for Auger effect and for X-rays for all shells of the Br atom were calculated and compared, and they show that the excess charge in this case becomes as high as $4{\cdot}7e$. The effect on homopolar binding is examined by using a H_2 molecule model. It is found that excess charges considerably less than $4{\cdot}7e$ should cause dissociation in the Br case.

1349 539.185

Magnetic scattering of neutrons. HAMERMESH, M. *Phys. Rev.*, 61, *pp.* 17–18, *Jan.* 1 *and* 15, 1942.—The problem of magnetic scattering of neutrons has been reconsidered [Abstr. 1927 (1941)]. The possible sources of error in the previous estimate are discussed. The form factor of the 3*d* shell of iron has been recalculated, with Hartree functions for Fe. This results in removal of the discrepancy between theory and experiment. Some predicted results of measurements with mono-energetic neutrons are given.

See Abstr. 1346 539.185.9 : 539.166.9 : 539.164.9

1350 539.2 : 541.24

The micellar theory of the structure of rubber. GEE, G. *Trans. Faraday Soc.*, 38, *pp.* 109–115, *Feb.–March*, 1942.

1351 539.2 : 541.6 : 532.7 = 3

On molecular states of order and some properties dependent on them in macromolecular substances. MEYER, K. H., WÖHLISCH, E., AND MÜLLER, F. H. *Kolloid Z.*, 97, *pp.* 105–106, *Oct.*, 1941.—Remarks on priority [Abstr. 1121 (1942)]. R. N.

1352 539.214.9 = 3

The plasticity of ice. HÖPPLER, F. *Kolloid Z.*, 97, *pp.* 154–160, *Nov.*, 1941.—Measurements were made with a consistometer [Abstr. 1401 (1942)] to determine flow curves of ice in the range $-1°$ to $-30°$C., with sliding pressures up to 63 kg./cm.^{2}. Ice consisting of parallel-axis poly-crystals shows a yield point, quasi-plastic flow at low, and pure plastic flow at high sliding pressure. A quasi-viscosity is defined, dep. on temperature and sliding pressure, and found as the cot. of the slope angle of the curve representing speed of flow as function of sliding pressure. The results are compared with those of previous investigators. R. N.

1353 539.215.4

Determination of particle-size distribution for particle sizes between 40 and 1 or 2 microns. HINKLEY, W. O. *Industr. Engng Chem.* (*Analyt. Edit.*), 14, *pp.* 10–15, *Jan.* 15, 1942.—The sedimentation method, using Stokes' law, is applied to finding the ratio of the amount of solids in a given volume before settling, and at a given depth after a calculated time, by determining the amount of solids in a pipetted sample by use of a sp. gr. bottle instead of by evaporation to dryness and weighing. Practical details and method of calculation are given. N. M. B.

1354 539.216 = 3

Contribution to the interpretation of supermicroscopical pictures of fibrous specimens. FRANZ, E., WALLNER, L., AND SCHIEBOLD, E. *Kolloid Z.*, 97, *pp.* 36–37, *Oct.*, 1941.—The super-microscopical picture of a section of a viscose film cut by a microtome shows that it is not permissible to assume that a plane section is obtainable. In the interpretation account must be taken of the effects caused by the electron beams on the object to be investigated. Thus the blister structures shown in some pictures [Abstr. 920 (1941)] may be explained by the action of these beams. R. N.

1355 539.216 : 539.26 = 3

Quantitative methods for determining the degree of orientation of stretched cellulose fibres, their limitations and mutual relations. HERMANS, P. H. *Kolloid Z.*, 97, *pp.* 223–228, *Nov.*, 1941.—A critical survey of various methods based on the X-ray diagram, anisotropy of swelling, optical anisotropy, refractability and dichromatism. Only the first method allows of determining the total distribution function of orientation while the other methods furnish average values of the angle of orientation. None of the methods is universally applicable, and the results obtained by the different methods are not easily comparable. For the further development of a theory systematic experimental work is desirable, especially applying the different methods in parallel. [See Abstr. 1121 (1942)]. R. N.

See Abstr. 1407 539.216.1 : 667.2 : 541.183

See Abstr. 1408 539.216.1 : 667.2 : 541.183.2

1356 539.216.2

Order in the alloy Cu_3Au. GERMER, L. H., HAWORTH, F. E., AND LANDER, J. J. *Phys. Rev.*, 61, *p.* 93, *Jan.* 1 *and* 15, 1942.

1357 539.26

Indexing powder diffraction patterns of isomorphous substances. FREVEL, L. K. *J. Appl. Phys.*, 13, *pp.* 109–112, *Feb.*, 1942.—Two methods are presented: the first depends on matching the log d values of 2 or more isomorphs (d being the interplanar spacing of a given reflection); the second relates the spacing shifts, $\Delta d/d$, of 2 isomorphs to the symmetry of the particular crystal system. These methods are made practical by the publication of tabulated powder-diffraction data.

1358 539.26 = 3

On the derivation of an "average angle of orientation" from the X-ray diagram. BOOYS, J. DE, AND HERMANS, P. H. *Kolloid Z.*, 97, *pp.* 229–231, *Nov.*, 1941.—Various methods are discussed for defining an average angle of orientation based on the X-ray diagram [see Abstr. 1355 (1942)]. All the definitions lead to some uncertainty. R. N.

See Abstr. 1355 539.26 : 539.216

1359 539.27 = 3

Investigations on electrolytically produced and tempered layers of aluminium oxide by means of electron interferences and in the super-microscope. HASS, G., AND KEHLER, H. *Kolloid Z.*, 97, *pp.* 27–35, *Oct.*, 1941.—Layers of Al_2O_3 are very useful as structure-free carriers for various substances in interference and super-microscopic investigations as long as they are not heated above 650° C. If the layers are heated for 1 hr. each at 700°, 800° and 900°C., cumulative crystallization takes place. An increasing number of sharp interference lines is observed and the super-microscopic picture shows a multitude of crystals which grow with increased heat treatment. The lattice const. of the electrolytically produced layer was measured to be 8·06 Å while that of γ-Al_2O_3 produced by natural oxidation at higher temperatures is 7·9 Å. No transformation of the crystalline form was observed after heating at 900°C. for 1 hr. But the strong local heating caused by the intensive irradiation in the super-microscope causes a transition from the γ to the α form, besides the cumulative crystallization observed during the heat treatment. R. N.

1360 539.32 : 548

The variation with temperature of the principal elastic moduli of NaCl near the melting point. HUNTER, L., AND SIEGEL, S. *Phys. Rev.*, 61, *pp.* 84–90, *Jan.* 1 *and* 15, 1942.—The principal elastic moduli of single-crystal rods of NaCl were measured over the temperature range 20° to 804°C., the m.p., by a tripartite piezo-electric oscillator consisting of a quartz crystal driver, an intermediate fused silica bar and the NaCl specimen. The shear constants C_{44} and $(C_{11} - C_{12})$ decrease nearly linearly with temperature, reaching non-zero values at the m.p. The compressibility increases with temperature, but exhibits a sudden drop within a few deg. of the m.p. The results are compared with predictions based on Born's theory of the stability of crystal lattices.

1361 539.371 : 535.33 : 522.6 : 77

The curvature of photographic plates. PAGE, L. *Astrophys. J.*, 95, *pp.* 1–4, *Jan.*, 1942.

1362 539.383 = 3

X-ray stress measurement on unalloyed steels beyond the compression yield point. BOLLENRATH, F., AND OSSWALD, E. *VDI* [*Z. Ver. dtsch. Ing.*], 84, *pp.* 539–541, *July* 27, 1940.—As for tensile strain [Abstr. 727 B (1939)], X-ray measurements show that, also for compressive strain, the stresses are not uniformly distributed over the cross-section of the material beyond the yield point. An inherent state of stresses is set up, characterized by tensile strains at and near the surfaces and compressive strain at the core. This distribution is due to the fact that the interior crystallites obstruct each other during the plastic deformation more than those nearer the surface. R. N.

See Abstr. 1428 539.389.1 : 548

PHYSICAL CHEMISTRY

1363 541.118

The thermal decomposition of *n*-butylamine. BEACHELL, H. C., AND TAYLOR, H. A. *J. Chem. Phys.*, 10, *pp.* 106–110, *Feb.*, 1942.—The thermal decomposition of *n*-butylamine proceeds in a manner analogous to that of the lower aliphatic amines. There is no evidence to support the suggestion of a molecular split into ammonia and ethylene. Pressure change rates yield an apparent energy of activation of 89 k.cals.

See Abstr. 1312 541.121 : 537.226.2

1364 541.123.33

The system silver-nitrate–dioxane–water at 25°. SKARULIS, J. A., AND RICCI, J. E. *J. Amer. Chem. Soc.*, 63, *pp.* 3429–3431, *Dec.*, 1941.—Evidence is given for a solid dioxanate of $AgNO_3$, containing about 94·0% $AgNO_3$, and to which the tentative formula $(AgNO_3)_8 \cdot C_4H_8O_2$ is assigned.

1365 541.123.4

Partition ratios of some organic acids between water and ethyl ether. DERMER, O. C., MARKHAM, W. G., AND TRIMBLE, H. M. *J. Amer. Chem. Soc.*, 63, *pp.* 3524–3525, *Dec.*, 1941.

1366 541.124

Mechanism and chemical kinetics of organic reactions in liquid systems. HUGHES, E. D. *Nature, Lond.*, 149, *pp.* 126–130, *Jan.* 31, 1942.—This article is based on the Faraday Society's recent discussion on the subject [Abstr. 566 (1942)]. A reaction may follow different mechanisms in not very drastically altered circumstances. The reactions reviewed in detail involve 3 main processes, closely related, viz. substitution, elimination and addition. Substitution and elimination occur together so often as to suggest that the duality of mechanism established for the former has a parallel for the latter; this is found to be the case. In the study of the kinetics and mechanism of ring-closure, the reactions which have yielded the most profitable results are those which involve an internal nucleophilic substitution. In the replacement of hydrogen in the aromatic nucleus, the reaction rate depends primarily on the electrophilic activity of the reagent and the electron availability at the reaction centre. Addition to definite compounds is related to electrophilic substitution. The analogy between neutral radicals and electrophilic reagents has limitations. H. H. HO.

1367 541.124

Kinetics of the thermal decomposition of straight-chain paraffins. BURK, R. E., LASKOWSKI, L., AND LANKELMA, H. P. *J. Amer. Chem. Soc.*, 63, *pp.* 3248–

3250, *Dec.*, 1941.—The constancy of the activation energy for the thermal decomposition of a straight-chain paraffin, calculated from experimentally determined velocity const. using the equation $-dM/dt = M(n-1)ve^{-E/RT} = Mk$, derived from the Burk mechanism, which assumes equally probable scission of C–C bonds to form an olefin and a new hydrocarbon, corroborates the assumptions of that mechanism. The rate of decomposition for a simplified chain mechanism is proportional to a power of n at least as great as $(n-2)^2(n-1)^{\frac{1}{2}}$, where n is the number of C atoms in the decomposing hydrocarbon. Such a proportionality predicts a rate of decomposition many times more rapid than experiment.

1368 541.124

Exchange and transfer equilibria of acids, bases and salts, in deuterium–protium oxide mixtures. The ion product constant of deuterium oxide. KINGERLEY, R. W., AND LA MER, V. K. *J. Amer. Chem. Soc.*, 63, *pp.* 3256–3262, *Dec.*, 1941.

1369 541.124

The effect of solvent on some reaction rates. WESTHEIMER, F. H., AND JONES, W. A. *J. Amer. Chem. Soc.*, 63, *pp.* 3283–3286, *Dec.*, 1941.

1370 541.124

The influence of hydroxyl ion concentration on the autoxidation of hydroquinone. GREEN, J. R., AND BRANCH, G. E. K. *J. Amer. Chem. Soc.*, 63, *pp.* 3442–3444, *Dec.*, 1941.—The expression $\{-d(O_2)/dt = k(O_2)(C_6H_6O_2)(OH^-)^{3/2}\}$, obtained by La Mer and Rideal for the rate law of the autoxidation of hydroquinone, has been confirmed. A chain mechanism has been proposed for the reaction. By a change of the state of ionization of the phenol in one of the steps, this mechanism is applicable to the autoxidation of catechol.

1371 541.124

The acid-catalysed hydrolysis of ethyl esters of aliphatic acids. SMITH, H. A., AND STEELE, J. H. *J. Amer. Chem. Soc.*, 63, *pp.* 3466–3469, *Dec.*, 1941.

1372 541.124

Rates and mechanism of phase changes in binary mixtures of alkali halides. MATSEN, F. A., AND BEACH, J. Y. *J. Amer. Chem. Soc.*, 63, *pp.* 3470–3473, *Dec.*, 1941.—Using X-ray powder photographs, the rates and mechanisms of the formations of solid solutions in equimolal mixtures of KCl–KBr, NaCl–NaBr and NaCl–KCl at several temperatures were observed, and also, qualitatively, the rates of decomposition of the solid solution of NaCl–KCl.

1373 541.126

Explosion hazard in the chlorination of alkyl isothioureas to prepare alkyl sulphonyl chlorides. FOLKERS, K., RUSSELL, A., AND BOST, R. W. *J. Amer. Chem. Soc.*, 63, *pp.* 3530–3532, *Dec.*, 1941.

See Abstr. 1307 541.126 : 536.66

1374 541.127

A new method for the determination of equivalent cracking conditions for commercial cracking reactions. NEPPE, S. L. *J. Inst. Petrol*, 28, *pp.* 27–35, *Feb.*, 1942.—A chart is given showing that a straight-line relationship exists between the factor F_t for which velocity of cracking is doubled and the cracking temperature t. The relation can be expressed algebraically as $F_t = 0{\cdot}04t - 10$. An equation has been derived from theoretical considerations. This very closely defines the relation between time of cracking and temperature for ordinary commercial cracking under const. pressure for a definite yield of product. Another chart is given for converting cracking conditions at any one temperature or period into equivalent cracking conditions at any other specified temperature or period.

1375 541.128

The thermal decomposition of acetone catalysed by iodine. GANTZ, G. M., AND WALTERS, W. D. *J. Amer. Chem. Soc.*, 63, *pp.* 3412–3419, *Dec.*, 1941.—The homogeneous decomposition of acetone catalysed by iodine has been studied in the region 470°–517°. With increasing pressures of iodine the catalytic effect reaches a max. and then decreases to an almost const. value. The catalysed decomposition is retarded by addition of nitric oxide, propylene or ethylene. Spectroscopic observations showed that, with low iodine pressures, the iodine disappears for a short time during the decomposition. The effect of methyl iodide on the acetone decomposition was comparable to that of iodine, ethyl iodide was less effective and isopropyl iodide had practically no effect.

1376 541.128

The catalytic decomposition of ammonia over iron synthetic ammonia catalysts. LOVE, K. S., AND EMMETT, P. H. *J. Amer. Chem. Soc.*, 63, *pp.* 3297–3308, *Dec.*, 1941.

1377 541.128

The base-catalysed decomposition of nitramide in aqueous solution. TONG, L. K. J., AND OLSON, A. R. *J. Amer. Chem. Soc.*, 63, *pp.* 3406–3411, *Dec.*, 1941.—When the logs of the sp. rates of catalysis are graphed against the log of the basic consts. of the catalysts, a curve such as that postulated in the original work by Brønsted and Pedersen is obtained.

1378 541.128

Kinetics of the trivalent vanadium-oxygen reaction. RAMSEY, J. B., SUGIMOTO, R., AND DEVORKIN, H. *J. Amer. Chem. Soc.*, 63, *pp.* 3480–3486, *Dec.*, 1941.—The rate laws have been established in absence of Cu and when catalysed by Cu. Probable mechanisms are proposed. Variation in the "dust particle" content of the different stock solutions of trivalent V is suggested as a reason for the different values of the rate constants obtained for the uncatalysed reaction. The critical increments have been determined and found to have the relative values expected. The rate of the uncatalysed reaction is independent of the salt conc., while that of the catalysed reaction has a positive salt effect over the range of ionic strength, 0·1 to 1·0. A mechanism of the induced catalysis of the oxygen-iodide reaction is suggested.

1379 541.128

Catalysts for the polymerization of benzyl chloride. DERMER, O. C., AND HOOPER, E. *J. Amer. Chem. Soc.*, 63, *pp.* 3525–3526, *Dec.*, 1941.

1380 541.128 : 541.634

Isomerizations of polyene acids and carotenoids. Preparation of β-eleostearic and β-licanic acids. STRAIN, H. H. *J. Amer. Chem. Soc.*, 63, *pp.* 3448–3452, *Dec.*, 1941.—Some polyene acids were altered in different ways by various isomerization catalysts.

With iodine, the products were *cis–trans* isomers. With others, the products were complex polymers. Isomerization of carotenoids by organic acids was prevented by organic bases. Isomerization of the carotenoids by iodine took different courses in the presence and in the absence of organic bases. Strong alkalis and certain adsorbents also caused alteration of the carotenoid pigments.

1381 541.132

The activity coefficients of the undissociated part of weak acids. II. Oxalic acid. LARSON, W. D., AND TOMSICEK, W. J. *J. Amer. Chem. Soc.*, 63, *pp.* 3329–3331, *Dec.*, 1941.—From measurements of the cell $Hg \mid Hg_2C_2O_4(s), H_2C_2O_4(c) \mid H_2$, the standard e.m.f. of the $Hg \mid Hg_2C_2O_4(s), C_2O_4^{=}$ electrode is found to be $-0{\cdot}4173 \pm 0{\cdot}0001$ V. These measurements indicate that the activity coeff. of the undissociated oxalic acid does not change in value over an ionic strength range of 0·02 to 0·17. Recalculation of the e.m.f. data for the cell $Cd\,(Hg) \mid CdC_2O_4.3H_2O(s), H_2C_2O_4\,(m)$, quinhydrone $\mid$ (Pt) indicates that the activity product of Cd oxalate is a const. over the ionic strength range from 0·025 to 0·33. The activity coeff. of undissociated oxalic acid over the same ionic strength range does not change.

1382 541.132

The electron-sharing ability of organic radicals. XIV. The effect of the radicals on the ionizing power of organic solvents. MOORE, F. J., AND JOHNS, I. B. *J. Amer. Chem. Soc.*, 63, *pp.* 3336–3338, *Dec.*, 1941.—The conductances and ionization const. of picric acid in acetone, methyl ethyl ketone, acetophenone, propionitrile and benzonitrile have been determined. The const. depend on the electron-sharing ability of the radicals in the solvent molecule rather than on the dielectric const. of the solvent.

1383 541.132 : 536.6

The ionization constant of propionic acid in dioxane-water mixtures. HARNED, H. S., AND DEDELL, T. R. *J. Amer. Chem. Soc.*, 63, *pp.* 3308–3312, *Dec.*, 1941.—The e.m.f.'s of the cell $He_2 \mid HP\ (m_1)$, NaP (m_2), NaCl $(m_3) \mid AgCl–Ag$ have been determined in dioxane-water mixtures containing 20, 45, 70 and 82% dioxane. Measurements were made at 5 deg. intervals from 0° to 50° for the first three mixtures and from 5° to 45° for the 82% dioxane mixture. From these results, the ionization const. of propionic acid was evaluated. The ionization const. of formic, acetic, propionic acids and water in dioxane-water mixtures are expressed by $\log K = -(A^*/T) + D^* - C^*T$. Values of the free energy, heat content, heat capacity and entropy changes at 25° accompanying ionization are given.

1384 541.133.1

The variation of the transference numbers of sodium chloride in aqueous solution with temperature. II. ALLGOOD, R. W., AND GORDON, A. R. *J. Chem. Phys.*, 10, *pp.* 124–126, *Feb.*, 1942.—The transference numbers of NaCl from 15° to 45°C. for conc. up to 0·1*N* have been determined by the moving-boundary method; both anion and cation boundaries were employed. The results for 25° are in close agreement with those of Longsworth. Extrapolation to infinite dilution is warranted, but not for higher conc. The transference numbers for NaCl and those previously obtained for KCl [Abstr. 2240 (1940)] combined with conductance data [Abstr. 1385 (1942)] yield values of the ionic mobilities for the whole temperature range.

1385 541.133.1

The conductance and ionic mobilities for aqueous solutions of potassium and sodium chloride at temperatures from 15° to 45°C. GUNNING, H. E., AND GORDON, A. R. *J. Chem. Phys.*, 10, *pp.* 126–131, *Feb.*, 1942.—The conductance was determined at 15°, 25°, 35° and 45°C. for conc. from 0·0005*N* to 0·01*N* by a modified d.c. method of high precision. At 15° and 25° the results are in agreement with data obtained by the a.c. bridge. For all temperatures, the conductance can be represented by the extended Onsager–Shedlovsky equation. A calculation shows that for all temperatures the Kohlrausch rule of independent ionic mobilities is obeyed at inf. dilution within the apparent limit of error of the measurements —0·02 to 0·03%. The conductance and ionic mobilities for round values of the conc., and the temperature coeff. of the ionic mobilities at inf. dilution, are tabulated.

1386 541.134

Physico-chemical studies with aqueous fluoride solutions. I. The decomposition and discharge potentials of some fluorides in aqueous solution. SHRIVASTAVA, H. *Proc. Indian Acad. Sci. A*, 14, *pp.* 535–546, *Nov.*, 1941.—The decomposition potentials of various fluorides, and the cathode and anode discharge potentials of some in aqueous solution, have been determined at 25°C. at various conc., using polished Pt electrodes. The current/voltage curves for LiF, NaF, KF, NH_4F and KHF_2 have an initial break at about $1{\cdot}55 \pm 0{\cdot}05$ V for each conc., and another break at a higher potential which varies with the nature of the metallic ion, and also with the conc. of the fluoride solution. The curve for SbF_3 also has 2 breaks, each of which, however, varies with conc. The curves for HF, CdF_2 and AgF have only 1 break each. Of the current/cathode-potential and current/anode-potential curves obtained, only the current/cathode-potential curves for NH_4F, KHF_2 and SbF_3 have 2 breaks corresp. to the respective breaks in the decomposition current/voltage curves; the other curves have only 1 break each. These results are discussed in detail and the inference is drawn that even alkali fluorides may have a true decomposition potential in aqueous solution.

1387 541.135.2

The electrolysis of rare-earth acetates and the separation of europium as amalgam from other rare earths. MCCOY, H. N. *J. Amer. Chem. Soc.*, 63, *pp.* 3432–3433, *Dec.*, 1941.—By the electrolysis of aqueous solutions of Eu, Yb or Sn acetates and K citrate, amalgams are formed, the yield decreasing in the order given. The same elements, in like solutions, give amalgams when stirred with K amalgam. None of the other rare earths similarly treated gave amalgams. Eu and probably Yb can be separated from accompanying rare earths by means of their amalgams.

1388 541.138.3

The electrolytic preparation of ethyl glyoxylate. OROSHNIK, W., AND SPOERRI, P. E. *J. Amer. Chem.*

Soc., 63, *pp.* 3338–3339, *Dec.*, 1941.—A method for preparing ethyl glyoxylate alcoholate in good yields by the electrolytic reduction of ethyl oxalate in non-aqueous media is developed.

1389 541.14 : 77

Direct processes for making photographic prints in colour. MEES, C. E. K. *Commun. No.* 832 *Kodak Res. Lab. J. Franklin Inst.*, 233, *pp.* 41–50, *Jan.*, 1942.—A description is given of the 2 processes now available by means of which prints in natural colours may be obtained. A. H.

1390 541.14 : 77

A technique for examining latent-image distribution. STEVENS, G. W. W. *Commun. No. H*831 *Kodak Res. Lab. Photogr. J.*, 82, *pp.* 42–47, *Feb.*, 1942.—A description is given of the experimental foundation on which is based the new technique for examining the distribution of the latent image between an outer region representing the surface and an inner region representing the interior of silver halide grains. This is followed by a brief discussion of the causes which make such a differentiation possible. Working instructions are given. A. H.

1391 541.141

Photochemical studies. XXXIII. The photochemical decomposition of acetone in the presence of an inert gas. HOWLAND, JR., J. J., AND NOYES, JR., W. A. *J. Amer. Chem. Soc.*, 63, *pp.* 3404–3406, *Dec.*, 1941.—At low intensities the addition of large amounts of CO_2 to acetone causes an increase in the quantum yield of CO formation from the latter. The data agree with the mechanism previously presented [see Abstr. 2784 (1940)]. Part of the CO is also formed during the primary process. The reaction leading to biacetyl seems to be largely a wall reaction at low intensities and to become increasingly a homogeneous gas-phase reaction at high intensities and also at high pressures.

1392 541.141 : 77 = 3

On the phenomena by solarization and cauterization of ripening nuclei. LÜPPO-CRAMER. *Kolloid Z.*, 97, *pp.* 198–201, *Nov.*, 1941.—The mechanism of solarization is explained by "germ poisoning," characterized by the formation of a barrier layer of halogene silver on the surface of the degerminated grains. The process and the methods for making it innocuous, e.g. by cauterization of the nuclei, are discussed in reviewing previous papers of the author and other investigators. R. N.

1393 541.141.1

Photolysis of methyl bromide. GORDON, A., AND TAYLOR, H. A. *J. Amer. Chem. Soc.*, 63, *pp.* 3435–3441, *Dec.*, 1941.—The photolysis of CH_3Br, chiefly by light of λ2 537 Å, gives a quantum yield based on Br produced of 4×10^{-3}; the other principal products are CH_4 and CO. In the presence of NO, the quantum yield based on nitrosyl bromide produced is ~ 1; the low yield in pure CH_3Br photolysis is due to the back reaction. In presence of Ag the quantum yield based on CH_4 production is ~ 1; CH_4 and CO are the sole products. The absence of C_2H_6, denying the possibility of recombination of methyl radicals, is accounted for by ~ 6 k. cal. difference in the energy of activation of C_2H_6 and CH_4 production. Increase of temperature up to 250° does not change these results qualitatively. From data at room temperature and at 100°, the energy of activation of CH_4 production is 6·6 k. cal. The presence of CO is due to reaction of CH_2Br radicals with SiO_2. N. M. B.

1394 541.141.12

The photolysis of ketene in the presence of hydrogen and methane. ROSENBLUM, C. *J. Amer. Chem. Soc.*, 63, *pp.* 3322–3329, *Dec.*, 1941.

1395 541.145

The photolysis of azomethane in the presence of hydrogen. TAYLOR, H. A., AND FLOWERS, R. G. *J. Chem. Phys.*, 10, *pp.* 110–115, *Feb.*, 1942.—The photolysis of azomethane in presence of hydrogen in the temperature range 20–200°C. yields ethane at a rate independent of the hydrogen. At low temperatures methane production is decreased by the presence of hydrogen but the rate increases with temperature faster than from azomethane alone. A mechanism involving CH_5 is suggested which accounts qualitatively for the observations. The same mechanism accounts for the decomposition of mercury dimethyl. The reaction producing methane from methyl radicals and hydrogen is not $CH_3 + H_2 \rightarrow CH_4 + H$. This is supported by the absence of hydrogen atoms during the azomethane photolysis studied.

1396 541.18 : 532.1 : 541.24 = 3

Structural mechanics of highly elastic continua. V. Viscosity and molecular weight. UMSTÄTTER, H. *Kolloid Z.*, 97, *pp.* 53–61, *Oct.*, 1941.—[See Abstr. 1333 (1941)]. In the range of half the critical temperature the viscosity/temperature function is analogous to Clausius–Clapeyron's steam-pressure equation, and the equation of state of liquids takes the form of that of ideal gases. With equal inner pressure and equal slope of the viscosity/temperature curve the mol. wt. is proportional to half the critical temperature. This leads to a method for determining the average mol. wt. of dissolved substances which is discussed. The method is specially suitable for the investigation of substances with high or medium mol. wt. when the osmotic methods are not sufficiently accurate. R. N.

1397 541.18 : 532.61 = 3

A novel method for determining the foaming capacity and the introduction of an average life τ for characterizing it. HOFFMANN, K., AND PETER, H. *Kolloid Z.*, 97, *pp.* 161–170, *Nov.*, 1941.

1398 541.18 : 532.77 : 532.1

The specific viscosity of suspensions and solutions. MARDLES, E. W. J. *Trans. Faraday Soc.*, 38, *pp.* 47–54, *Feb.–March*, 1942.—[See Abstr. 2920 (1940)].—The ratio η/η_0, where η is the viscosity of a suspension of a finely-divided solid or solution of a colloid or crystalloid in a liquid medium of viscosity η_0 at the temperature of the experiment, was found for a variety of suspensions and solutions to be a function of η_0, being smaller for lower values of η_0, especially below about 2 centipoises. The methods of varying η_0 were (*a*) by using liquids in the same homologous series, (*b*) by using binary mixtures of liquids, and (*c*) by changing the temperature of the experiment. The viscosity effect observed appears to be explicable by assuming orientation of the dispersed particles during flow, less eddying of the medium occurring in the thinner liquids when the particles assume more quickly positions of streamline flow.

1399 541.18.04

Kinetics of sol–gel transformation. V. The influence of different coagulating electrolytes on the setting of ferric phosphate gel. DUBE, H. L., AND PRAKASH, S. *Proc. Indian Acad. Sci. A*, 14, *pp.* 577–583, *Nov.*, 1941.—The values of p, the jelly characteristic, and R, the rate const., in the equation $\log S = \log R + p \log C$, do not change much with uni-univalent electrolytes. The slight variations with chloride, bromide and nitrate ions are due to the different adsorbabilities of these ions by ferric phosphate. When the jelly formation is affected with uni-polyvalent ions, the marked variations are observed consistent with Whetham's law, or any other generalized expression. With poly-univalent electrolytes, the values of p and $\log R$ do not markedly change, as the sol itself is positively charged.

1400 541.18.043 = 3

The air-driven ultra-centrifuge. SCHRAMM, G. *Kolloid Z.*, 97, *pp.* 106–115, *Oct.*, 1941.—An illustrated progress review with a bibliography of 33 publications. R. N.

1401 541.182 : 532.1 = 3

Pressure lyosorption. HÖPPLER, F. *Kolloid Z.*, 97, *pp.* 61–71, *Oct.*, 1941.—When tested in a consistometer, which yields the functional relation between speed of flow and pressure, certain substances, e.g. coal tar, coal tar pitch and bitumen, show an anomalous behaviour. At l.p. the flow curve resembles that of pure viscous substances, at h.p. it approaches that of a plastic. This behaviour is explained by an isothermic transition from the sol to the gel state caused by the pressure at a temperature below which gel formation would occur. R. N.

1402 541.182.2

Experiments on foam time. I. The method of measuring foam time and some experiments with saponin and methyl cellulose. II. Experiments with aliphatic alcohols and a relation between chain length and foam time. Critical foam time and conjugate foaming solutions. SCHÜTZ, F. *Trans. Faraday Soc.*, 38, *pp.* 85–104, *Feb.–March*, 1942.—Foam-time/concentration curves of alcohols showed one max. of foam time at a certain conc. This conc. (c) for normal alcohols was found to be related to the number of C-atoms (n) in the molecule, and this relation could be expressed by the equation $c = ab^n$ where a and b are const. From the graphically obtained const. the calculated values of c are in agreement with the experimental values, with the exception of methyl alcohol. It is shown that in mixtures of isomers certain features are well expressed in the curves which are due to one component only. Experiments with staining the foaming solutions by means of different dyestuffs are described, and, based on these experiments, an explanation of the critical foam times is discussed.

1403 541.182.5 = 3

Some special considerations on gel structure and swelling. HERMANS, P. H. *Kolloid Z.*, 97, *pp.* 231–237, *Nov.*, 1941.—The changes of shape during the shrinking of the 3-dimensional network structure, formed by non-porous gels when dried, are discussed in relation to the pliability of molecular chains. Phenomena observed in quantitative investigations on deformation and orientation of isotropic cellulose gels may thus be explained. In the swollen state the max. ductility is $\propto$ (degree of swelling)$^{-1/3}$. Shrinking and swelling of the isotropic gel proceed parallel with reduction and increase, respectively, of the radii of curvature throughout the network. Recrystallization phenomena may also be explained by these considerations. R. N.

1404 541.182.6 = 3

On the constitution of diluted soap solutions. V. Hydrolysis of sodium caprate. EKWALL, P. *Kolloid Z.*, 97, *pp.* 71–80, *Oct.*, 1941.—The hydrolysis of sodium caprate is investigated to illustrate the theory [Abstr. 906 (1941)]. The states of turbidity and their dependence on conc. are discussed. The trend of the curve showing the degree of hydrolysis as a function of conc. agrees with theory. In soap solutions the formation of colloids is preceded by an anion association progressing step by step. R. N.

1405 541.182.6 = 3

On representing the stability of colloidal systems by isochrones and on some observations on SiO_2-sols. DOBROWSKY, A. *Kolloid Z.*, 97, *pp.* 80–87, *Oct.*, 1941.—The properties, especially the stability, of a 2-compound sol when a third substance is added are represented in a reference triangle. Points of equal stability, characterized by the time required for the transition from the sol to the gel state, are connected by isochrones giving the time in logarithmic scale. By this method the system sodium–silicate–acid–water was investigated with various acids. Change in stability is $\propto$ decline of pH with increasing conc. If the points of shortest life of the sols or quickest formation of gels, i.e. the apices of the isochrones, are connected, so-called tachydromes are found, which are straight lines for monovalent and curved for polyvalent acids. The results are compared with those of previous investigators. R. N.

1406 541.182.6 : 532.1 = 3

Viscosity and structure of hydrophile colloids. ROSSI, C. *Kolloid Z.*, 97, *pp.* 129–135, *Nov.*, 1941.—By measurements of the inner friction of 5%, 4%, 3·5% and 2% suspensions of bentonite, made in a Couette viscosimeter, a distinct friction hysteresis was established, increasing with dilution. The average friction coeff. depends on the speed. An equilibrium of viscosity is also obtainable if the liquid is kept in motion at different speeds. The difference is stressed between friction hysteresis, e.g. thixotropy, rheopexy etc., and the change of friction due to change in speed. The latter is probably of a purely hydrodynamical nature while the former is due to the slow formation of an internal structure. A tentative explanation is given, based on the interlinkages between the dispersed particles and the molecules of the dispersion medium. R. N.

See Abstr. 1240 541.182.6 : 532.13

See Abstr. 1301 541.182.6 : 536.55

1407 541.183 : 539.216.1 : 667.2 = 3

Dyestuff adsorption on cellulose and its grinding products. HESS, K., AND GRAMBERG, W. *Kolloid Z.*, 97, *pp.* 87–96, *Oct.*, 1941.—Investigations were made on the adsorption of dyestuffs on various types of cellulose fibres subjected to varying periods of grinding [Abstr. 2446 (1941)]. The relative amount of

dyestuff adsorbed is a characteristic value for the cellulose preparation and may serve for an approx. determination of the total surface of the crystalline coherent micelles. The influence of recrystallization of the ground cellulose on the adsorption of dyestuffs is also investigated. Graphs are given showing the adsorption values with different conc. of dyestuffs as a function of time. Adsorption isotherms show that saturation has not yet been reached even with the highest conc. investigated. X-ray diagrams and microphotographs are given and discussed. R. N.

1408 541.183.2 : 539.216.1 : 667.2 = 3

Metachromatism and dichromatism of fibre dyeing as a result of size and shape of the fibre and dyestuff particles. ZIEGENSPECK, H. *Kolloid Z.*, 97, *pp.* 201–216, *Nov.*, 1941.

See Abstr. 1255 541.183.5 : 533.15

1409 541.24

The molecular weights of rubber and related materials. III. GEE, G. *Trans. Faraday Soc.*, 38, *pp.* 108–109, *Feb.–March*, 1942.—A correction. [Abstr. 7 (1941)].

See Abstr. 1396 541.24 : 532.1 : 541.18

See Abstr. 1350 541.24 : 539.2

See Abstr. 1275 541.571 : 535.338

1410 541.6

Fixation of aromatic double bonds. RANGASWAMI, S., AND SESHADRI, T. R. *Proc. Indian Acad. Sci. A*, 14, *pp.* 547–571, *Nov.*, 1941.

1411 541.6

The molecular structures of the dimers of Al dimethyl chloride, Al dimethyl bromide, and Al trimethyl, and of hexamethyldisilane. BROCKWAY, L. O., AND DAVIDSON, N. R. *J. Amer. Chem. Soc.*, 63, *pp.* 3287–3297, *Dec.*, 1941.—The structures of $Al_2(CH_3)_4Cl_2$, $Al_2(CH_3)_4Br_2$, $Al_2(CH_3)_6$ and $Si_2(CH_3)_6$ have been determined by means of electron diffraction. The 2 methyl Al halides have the bridged structure of 2 metal and 2 halogen atoms in a ring observed in other similar compounds, and the ring angles are close to 90°. $Al_2(CH_3)_6$ and $Si_2(CH_3)_6$ have ethane-like structures. The silicon compound has the bond lengths and angles expected for a normal covalent structure. In the Al compound the C–Al–C bond angles are 115° or larger. The Al–Al bond is surprisingly short in comparison with the Si–Si bond length.

1412 541.6

Chain length and chain-ending processes in acetaldehyde decomposition. BURTON, M., TAYLOR, H. A., and DAVIS, T. W. *J. Chem. Phys.*, 10, *p.* 146, *Feb.*, 1942.—A correction. [Abstr. 495 (1940)].

See Abstr. 1351 541.6 : 532.7 : 539.2

See Abstr. 1262 541.6 : 534.39

See Abstr. 1269 541.6 : 535.337

1413 541.6 : 535.338

Effect of silver ion co-ordination upon the Raman spectra of some unsaturated compounds. TAUFEN, H. J., MURRAY, M. J., AND CLEVELAND, F. F. *J. Amer. Chem. Soc.*, 63, *pp.* 3500–3503, *Dec.*, 1941.

1414 541.61

On the constitution of sodium silicate solutions. RAY, R. C., GANGULY, P. B., AND LAL, A. B. *Trans. Faraday Soc.*, 38, *pp.* 104–108, *Feb.–March*, 1942.—In the experiments now described an attempt has been made to study the constitution of sodium silicate solutions from their rates of diffusion. Experimental details are included. It is suggested that the basic molecular unit of the sodium silicate solutions is Na_4SiO_4. On this hypothesis, the 1 : 1-ratio silicate may be considered as the dihydrogen form, $Na_2H_2SiO_4$, and the 1 : 2-ratio as Na_2O, $2SiO_2$, $2H_2O$, or $Na_2H_4Si_2O_7$; the difference between the two is H_2SiO_3 or SiO_2, H_2O. If in solution, therefore, the 1 : 1-ratio meta-silicate be simply admixed with hydrated colloidal silica in molecular proportions, the loose combination attains the analytical ratio of $Na_2O : SiO_2$ as 1 : 2. Similarly, if one mole of the $Na_2H_2SiO_4$ silicate is loosely combined in solution with two moles of colloidal silica, the resulting system attains the analytical ratio of $Na_2O : SiO_2$ as 1 : 3. On this suggestion the different ratio silicate solutions of commerce are nothing but the silicate Na_4SiO_4 (or $Na_2H_2SiO_4$) mixed with 1, 2 or 3 moles of hydrated colloidal silica, the unit structure of which is SiO_2, H_2O. On this basis any intermediate fractional ratio becomes possible by simple variation of the amount of colloidal silica. Carman [Abstr. 2729 (1940)] has shown that the unit of colloidal silica should be taken as SiO_2, H_2O. H. H. HO.

1415 541.62

Isomerization equilibrium among the branched-chain pentenes. EWELL, R. H., AND HARDY, P. E. *J. Amer. Chem. Soc.*, 63, *pp.* 3460–3465, *Dec.*, 1941.

1416 541.621

Isomerization of naphthalyl chloride. FRENCH, H. E., AND KIRCHER, J. E. *J. Amer. Chem. Soc.*, 63, *pp.* 3270–3272, *Dec.*, 1941.

See Abstr. 1380 541.634 : 541.128

See Abstr. 1286 541.65 : 535.557

1417 541.653.3

The kinetics of the mutarotation of aminomethylene-*d*-camphor. SINGH, B. K., AND SEN, S. C. *Proc. Indian Acad. Sci. A*, 14, *pp.* 572–576, *Nov.*, 1941.

1418 541.66 : 532.62

The rôle of hydrogen bonds in condensed monolayers. ALEXANDER, A. E. *Proc. Roy. Soc. A*, 179, *pp.* 470–485, *Feb.* 27, 1942.—From the behaviour of monolayers of compounds containing the —CO . NH— linkage it is concluded that intermolecular H bonding can play a major rôle in determining the properties of condensed monolayers. Such effects tend to bring about condensation and solidification, and a marked increase in the half-expansion temperature. A detailed examination of the acetamides has been made in both the expanded and condensed regions by combined force-area and surface-potential methods. Comparison of the condensed films with those of the analogous acetates, where no intermolecular H bonding is possible, shows several striking differences. With the acetamides and ureas the H bonding has been shown to be sensitive to the *p*H of the substrate, very acid substrates leading to complete liquefaction. The H bond distances can be calculated and the values so obtained agree with those in the crystal for the same or similar head groups. The free-energy difference between the —CO . NH— group when forming H bonds to water (as in the expanded films), and when

cross-linked (as in the low-temperature form), is calculated for the acetamides to be about 840 cal./g.mol. Values of the same order can be calculated for the other systems discussed.

1419 541.8

Interaction of ions and dipolar ions. III. Solubility of thallous salts in glycine and in alanine solutions. KEEFER, R. M., AND REIBER, H. G. *J. Amer. Chem. Soc.*, 63, *pp.* 3504–3507, *Dec.*, 1941.

1420 541.8

Solubility of strychnine acid sulphate in sulphuric acid. ZWICKER, B. M. G., AND ROBINSON, R. J. *J. Amer. Chem. Soc.*, 63, *p.* 3538, *Dec.*, 1941.

1421 542 : 621.318.572

Electronic relays. REDFERN, S. *Industr. Engng Chem.* (*Analyt. Edit.*), 14, *p.* 64, *Jan.* 15, 1942.—[Abstr. 674 B (1942)].

1422 542.48

Immersion still head for low-pressure distillation of organic mixtures. BAILEY, A. J. *Industr. Engng Chem.* (*Analyt. Edit.*), 14, *p.* 71, *Jan.* 15, 1942.

1423 542.48

Theory of open-tube distillation columns. WESTHAVER, J. W. *Industr. Engng Chem.*, 34, *pp.* 126–130, *Jan.*, 1942.

1424 542.61

Agitation: Performance of propellers in liquid-solid systems. HIXSON, A. W., AND BAUM, S. J. *Industr. Engng Chem.*, 34, *pp.* 120–125, *Jan.*, 1942.—Previously derived relations [Abstr. 453 (1942)] are applied to a study of the rate of dissolution of solids in liquids in a series of geometrically similar vessels fitted with propeller stirrers. It is found that the dissolution const. K, for any particular liquid-solid system under isothermal conditions, is a function of the product of speed and size factor, nd, and this relation holds for several different agitator designs. The results for 4 liquid-solid combinations in propeller agitators over a temperature range of 6°–45°C. are correlated by the equation: $Kd/D = 3{\cdot}5 \times 10^{-4}(nd^2\rho/\mu)^{1{\cdot}0}(\mu/\rho D)^{0{\cdot}5}$. The methods and results indicate the utility of model experiments in prediction of agitator performance.

1425 542.76

Laboratory flowmeter with interchangeable precision-bore capillaries. CROXTON, F. C. *Industr. Engng Chem.* (*Analyt. Edit.*), 14, *pp.* 69–70, *Jan.* 15, 1942.

See Abstr. 1314 545.721 : 537.312.8

CRYSTALLOGRAPHY

1426 548 : 531.7 : 536.41

The lattice spacing and thermal expansion of copper. HUME-ROTHERY, W., AND ANDREWS, K. W. *J. Inst. Met.*, 68, *pp.* 19–26, *Feb.*, 1942.—The lattice spacings of 5 different samples of Cu were measured at room temperatures. The differences were comparatively small and could be accounted for by the different percentages of the various impurities. The lattice spacing of pure Cu is estimated to be 3·6074 Å at 18°C., and the difference between the observed density and that calculated from the lattice spacing is very unlikely to be due to impurities in the metal. The lattice expansion of Cu of 99·998% purity was measured at temperatures up to 871°C. Up to 500°C. there is good agreement between the expansion of the lattice and that of massive Cu, but at higher temperatures the expansion of the lattice is the smaller, and the reason for this is discussed.

See Abstr. 1322, 1323 548 : 535.3 : 537.531

1427 548 : 539.11

Transition-state theory of diffusion in crystals. BARRER, R. M. *Trans. Faraday Soc.*, 38, *pp.* 78–85, *Feb.–March, and p.* 214, *May*, 1942.—The transition-state theory of diffusion has been developed fully for Schottky, Frenkel and zeolitic mechanisms of diffusion. In the formula $D = D_0 e^{-E/RT}$, the simplest value D_0 may take is on the basis of this theory $\sim 3 \times 10^{-3}$ cm.^{2} sec.$^{-1}$, compared with $\sim 1{\cdot}7 \times 10^{-3}$ cm.^{2} sec.$^{-1}$ on the basis of the kinetic theory. The deviations from this simplest normal imposed by the different mechanisms are shown to cover a wide range of the experimental values of D_0. The effect of high pressures on diffusion and conductivity constants is discussed quantitatively.

See Abstr. 1360 548 : 539.32

1428 548 : 539.389.1

A stress/strain curve for the atomic lattice of mild steel, and the physical significance of the yield point of a metal. SMITH, S. L., AND WOOD, W. A. *Proc. Roy. Soc. A*, 179, *pp.* 450–460, *Feb.* 27, 1942.—A stress/strain curve is obtained for the atomic lattice of mild steel subjected to tensile stress. A set of atomic planes is selected of which the spacing is practically perpendicular to the direction of the stress applied to the tensile-test specimen, and which should contract with the cross-section as the specimen extends. Up to the external yield point the lattice spacing contracts in proportion to the applied stress; at the external yield point the spacing undergoes an abrupt expansion. As the stress is further increased, the lattice dimension remains approx. const. in the expanded condition. The sudden expansion is retained as the load is removed. With the application of increasing stress, the permanent expansion imposed on the lattice spacing systematically increases up to the ultimate stress preceding fracture. The sharp changes in the lattice spacing at the yield are accompanied by a drop in intensity of the X-ray diffraction ring on which the spacing measurements are based. The atomic lattice of a metal itself possesses a yield point which marks the onset of permanent lattice strains of an unexpected character and of direct technical interest in connection with the mechanical properties of metals.

1429 548.7 : 539.155.2

Structure and thermal properties associated with some hydrogen bonds in crystals. IV. Isotope effects in some acid phosphates. UBBELOHDE, A. R., AND WOODWARD, I. *Proc. Roy. Soc. A*, 179, *pp.* 399–407, *Feb.* 27, 1942.—[See Abstr. 27 (1940)]. The isotope effect has been measured for $(NH_4)H_2PO_4$. Expansion of the crystal lattice takes place on substituting deuterium for hydrogen. The expansion is in the direction of the H bonds, and is of the same magnitude as in the isomorphous KH_2PO_4. A contraction of the lattice at rt. angles to the plane containing the H bonds is considerably larger for $(NH_4)H_2PO_4$ than for KH_2PO_4. Investigations on the monoclinic form

of KD_2PO_4 have shown the presence of diffuse reflections in moving-film photographs.

1430 548.73

Structure of vitreous silica. ROOKSBY, H. P., AND THOMAS, L. A. *Nature, Lond.*, 149, *pp.* 273–274, *March* 7, 1942.

GEOPHYSICS

1431 550.835

Radioactive exploration. ROSE, R. B. *Min. Mag.*, 31, *pp.* 617–620 *and* 635, *Dec.*, 1941.—The physics of the radioactive elements are given and followed by an analysis of the various means of detection as applied to geophysics. The amounts of Ra in various types of rock and minerals are known and may be measured by plotting the γ-radiation over an area. Ionization-counting instruments form the commonest type of means of detection. One is described which is sensitive to 10^{-12} g. Ra at a distance of several ft.

E. H. W. B.

1432 551.508.2

Recalibration of instrumental equipment at solar radio stations. HAND, I. F., AND CULLINANE, H. F. *Mon. Weath. Rev., Wash.*, 69, *pp.* 262–264, *Sept.*, 1941.—The Eppley pyrheliometers at 13 stations in the U.S. have been calibrated by careful re-levelling and checking against either 10- or 50-junction substandards previously standardized directly against the Smithsonian silver-disc pyrheliometer. The average monthly e.m.f. and the percentage change from the previous mean factor are tabulated for each instrument. Where microammeters are in use, large changes (up to 7·9%) in reduction factor are necessitated by varying full-scale deflections. These instruments are to be replaced by the more stable potentiometers. A. HU.

1433 551.508.5

Comparison of extreme gust velocities as recorded by the Dines anemometer and 5-minute velocities as recorded by the Robinson anemometer. DYCK, H. D. *Mon. Weath. Rev., Wash.*, 69, *pp.* 301–302, *Oct.*, 1941.—Washington wind records for 1939 are used for comparing the Robinson "maximum" velocity (greatest number of miles recorded in 5 min.) with the Dines "extreme" velocity (mile recorded in the shortest time). The relation between the two is approx. parabolic. For 85% of the days studied, the max. velocity occurred within 1 hr. of the extreme gust; for these days the data are fitted by the same parabola. A. HU.

1434 551.508.91

Automatic dust sampling and analysing instrument for atmospheric pollution surveys. DAVIDSON, W. F. AND MASTER, W. *Mon. Weath. Rev., Wash.*, 69, *pp.* 257–260, *Sept.*, 1941.—The Owens air filter is modified by substituting a motor-driven exhaust pump and a diaphragm gas meter for the water siphon, a strip chart for the disc recorder, and a photoelectric scanner for the visual matching system. The instrument and its auxiliary apparatus are shown photographically and schematically. A. HU.

1435 551.577.37

A study of excessive rainfall. DYCK, H. D., AND MATTICE, W. A. *Mon. Weath. Rev., Wash.*, 69, *pp.* 293–301, *Oct.*, 1941.—"Excessive"-precipitation (rainfall occurring at a rate greater than 1 in./hr. or 2·5 in./day) is studied statistically from data recorded at 155 U.S. stations in the period 1908–37. The number of excessive rains is shown to be related logarithmically to average annual, but not to monthly, precipitation. The precipitation data are shown to be roughly applicable to areas extending 20 or 30 miles around the recording station. Maps of the U.S. are given showing the average frequency of occurrence of excessive rains, the percentage of the annual precipitation which falls at an excessive rate, the average and the greatest rate of all excessive rainfall, the max. amount of rain falling at an excessive rate, and the average duration of excessive rainfall. Extensive tabular data are also given. A. HU.

1436 551.593.63

The geometrical theory of haloes. VI. WOOLARD, E. W. *Mon. Weath. Rev., Wash.*, 69, *pp.* 260–262, *Sept.*, 1941.—[See Abstr. 569 (1938)]. The author investigates the optical meteors produced by atmospheric ice crystals in the form of hexagonal right prisms (columns or discs), hexagonal right pyramids (complete or truncated), and simple combinations of these forms. After a general discussion, the case of crystals which have 3 degrees of freedom and are oriented at random is discussed, and the resulting haloes enumerated, together with the corresponding refracting angles and crystal elements involved.

A. HU.

VARIOUS SUBJECTS

See Abstr. 1038	612.85 : 534.322.3
See Abstr. 1407	667.2 : 539.216.1 : 541.183
See Abstr. 1408	667.2 : 539.216.1 : 541.183.2
See Abstr. 1361	77 : 535.33 : 522.6 : 539.371
See Abstr. 1389, 1390	77 : 541.14
See Abstr. 1392	77 : 541.141